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LOCOMOTIVE FIRE-BOXES.

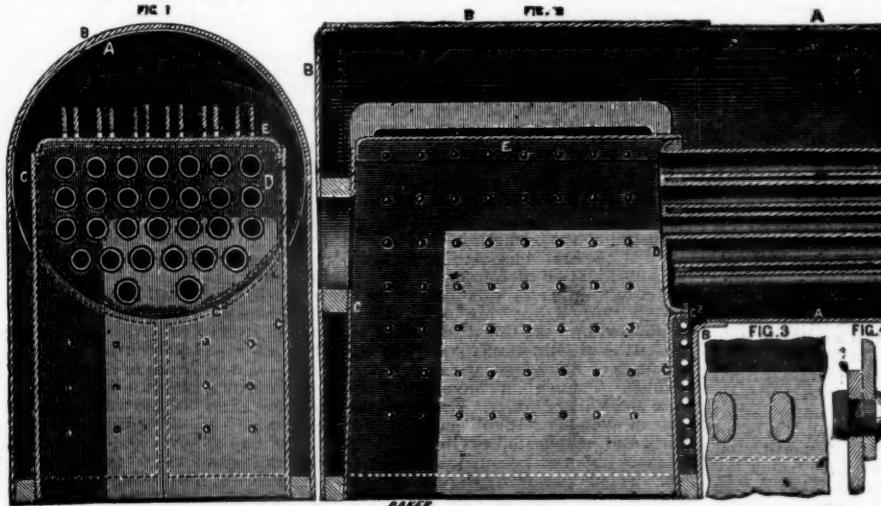
We illustrate a method of constructing the fire-boxes of locomotive or portable engines, lately presented by the London *Engineering* as the design and patent of Mr. F. W. Webb, of the Bolton Iron and Steel Works, England, who is also Locomotive Superintendent of the London & Northwestern Railway.

In our engravings, Fig. 1 is a transverse, and Fig. 2 a longitudinal section, of a fire-box constructed on Mr. Webb's plans; *A* being part of the cylindrical portion of the boiler, and *B* the outer casing of the fire-box; while *C* is a thin plate of iron or steel or other metal of sufficient length to form when bent the sides and the back and front of the fire-box and the flanged joint *C*. The plate, *C*, is of the height of the fire-box, and it is cut out and flanged back, as shown at *C*, to receive the tube plate, *D*, which may be of copper, riveted to the part flanged back. By this system of construction a thin plate is obtained for the body of the fire-box, thereby reducing its weight and cost, and a strong plate for the tubes. The plate, *E*, forming the top of the fire-box is flanged round on three sides, and it is riveted to the two sides and back of the fire-box and to the tube plate, *D*; and in order to insure a good joint around the tube plate a calking strip may be introduced between the flanges, so that the joint can at any time be repaired from inside of the fire-box, or the top plate may be plain and riveted to flanges on the body of the fire-box and tube plate; or instead of joining the ends of the plate, *C*, by flanging them as shown, the ends may form a jump joint and be secured together by a cover plate, or an ordinary lap joint may be made.

The inner and outer casings of the fire-box may be connected by stays, as usual, but as the inner casing can, by adopting the mode of construction we illustrate, be made of a thinner plate than usual, Mr. Webb prefers to use stay bolts, passing through a plain hole in the inner casing, *C*, and either screwed into or passed through a plain hole in the outer casing, *B*, the distance between the plates, *B* and *C*, being regulated by a short metal tube, surrounding the stay bolt, the nut on the bolt tightening the whole securely together. By the use of these stays, on slackening the nuts to release the inner plate, the scale may be easily detached by striking the inner box with a mallet on the inside.

The seam of the fire-box may be riveted in the ordinary manner, or according to a mode of riveting, also patented by Mr. Webb, and which consists in the use of oval or oblong rivets, as shown in Figs. 3 and 4, which represent a front view and section of a seam with one row of oblong rivets instead of round ones. The oval or oblong rivets are placed with their major axis in the direction of the greatest strain, so that the greatest strength is obtained, while the plate is not so much weakened as with round rivets. The arrangement of rivets just mentioned is applicable to beams, girders, and riveted work in general.

The operating officers of the New Orleans, Mobile & Chattanooga Railroad, now in operation between New Orleans and Mobile, are all Yankees of the deepest dye. The General Superintendent, James R. Kendrick, comes from the Concord Railroad of New Hampshire; the Assistant Superintendent, George T. Benedict, from the Vermont Central; the General Ticket Agent, G. G. Sanborn, from the Concord Railroad; and the General Freight Agent, W. J. Phelps, from the Connecticut River Road.



METHOD OF CONSTRUCTING LOCOMOTIVE FIRE-BOXES.

umes; I am not informed concerning its progress, only having heard that it is successful in the accomplishment of the object for which it was intended.

The most liberal provision for its local employees with which I am acquainted, is made by the Erie Railway Company at Susquehanna, where its main locomotive works are. The office building is three stories high, and contains, besides the offices for the Master Mechanic and his aids, a library and reading room upon the second floor, while the whole of the third story is occupied by an ample lecture room, furnished with rostrum and comfortable seats. In addition to these luxuries, which are intended for all the employees stationed at Susquehanna, the engineers and firemen have separate sitting rooms—one for each class—with bath rooms adjoining, where they can take their ease between trains; these apartments being in the building appropriated to the service of the engine dispatcher's department.

PROTECTION FOR CIVIL ENGINEERS.

Every civil engineer of ordinary ability knows that in the existing state of our profession any young man who serves in the position of engineer's assistant or roadman for a term of six months or a year can, with careful attention and ordinary capabilities, acquire sufficient knowledge of the profession to enable him to do most of the field work, such as leveling and setting out work, which of course is very good, and must be learned; but this is not all that is required to make a successful engineer and one that can be entrusted with the supervision of public works or works of magnitude. He must also have theoretical knowledge, together with judgment and experience. Most of our readers well know that a large percentage of our so-called civil engineers have only the qualifications I first mentioned, some of them even less. With such as these our ranks

are dotted, and we are obliged to recognize them as brother practitioners. Why can we not have some protection as well as all the other professions? Is it not as bad for an inexperienced engineer to build a bridge that will not be safe for public travel, and perhaps be the cause of death to hundreds, as it is to employ a quack doctor who will, by wrong treatment, perhaps kill more than he cures? One seems to me to be just as injurious as the other.

The medical profession has its colleges, at which diplomas are granted after a due course of examination, and why not ours, which stands pre-eminently above all others, embracing as it does the sciences and arts as well as requiring years of intense study and observation. Why cannot laws be passed that would oblige every civil engineer to hold a certificate of qualification in conjunction with a license, to practice? To obtain such license and certificate a board of examiners should be appointed by the Governor of each State, composed of three of the most learned civil engineers, to hold sessions yearly for the examination of candidates, at the capital or the largest and most centrally located city of each State. Said examiners might be appointed from year to year, or for a term of years, and paid for their services out of the proceeds accruing from the fees for licenses. This appears to me to be the only means by which we can protect our profession and the public in the proper construction of their works and expenditures of money so much entrusted to the ability and judgment of civil engineers.

Will some of our eminent engineers who pride themselves in this the most intellectual of professions, take these suggestions into careful consideration?

CIVIL ENGINEER.

The recent decision of Judge Shepley, in the case of the Boston, Hartford & Erie Railroad Company, affirmed that railroad corporations came under the head of "business corporations," under the United States Bankrupt Law. Referring to the decision, the Philadelphia *Ledger* says:

"This settles the fact that all bankrupt and fraudulently managed railways are amenable to the Bankrupt Court of the United States. Some learned lawyers have been apprehensive that once in bankruptcy the roads could never be relieved without final and irretrievable ruin to the stockholders. But such, it is now said, is not the practicable interpretation of the law, any more than in the case of a receiver and foreclosure under State proceedings, where the stock and bondholders having, through such receivership, rid themselves of bad management, are permitted to come together on agreed terms to relieve the property of its difficulties, and to reorganize without prejudice to any of the interested concerned."

A party was recently invited to make an excursion into the woods over the Flint & Pere Marquette Railroad, and at the same time informed that it would be well to bring lunch with them. A reporter gives these as incidents:

"One jolly looking fellow attracted considerable attention from the novel character of his lunch, which consisted of a demijohn of fluid and two crackers, and one of the crackers he insisted upon giving to the man who came without a lunch. A 'bogus conductor' made an attempt to gobble all the tickets, and then got into a quarrel with a man who drew a pocket-pistol on him because it did not carry large enough. This was the only event which occurred to mar the festivities of the occasion."

The Government and the Railroad Corporations.

Mr. Charles Francis Adams, Jr., who has made a special study of railroad corporations and their operations, and especially of their relations to the State and the nation, contributes an article with the above title to the January number of the *North American Review*. Mr. Adams has before made important contributions of this kind, such as the "Chapter of Erie," two years ago, and an other article in the same *Review* a year ago, and also very valuable ones in the reports of the Massachusetts Railroad Commissioners, copious extracts from which have appeared in these columns.

The last article is quite long, and, in copying, we make some omissions. First, we give the "preliminary statement of difficulties which should naturally lead to a suggestion of remedies."

The points in connection with the railroad system to which the public attention has heretofore chiefly been called in these pages are few in number. Most prominent among these has been the rapid growth of individual members of the system; the tendency to consolidation and combination in all the members; the scandalous, internal abuses, incident to corporate control, and, finally, the development of a disturbing, if not controlling, influence in our political system. A review of the incidents of the last year under each of these heads could hardly fail to be interesting, did time and space admit of it. As this, however, is out of the question, a few illustrations must suffice, from which much more may safely be inferred. In the matter of consolidation, for instance—the massing of great interests under one control—it is unnecessary to dwell upon the details of growth of each of those four trunk lines now rapidly parceling out among themselves all the Northern States east of the Missouri. The same principle of development, though manifesting itself through various outward phases, has controlled them all; *mutatis mutandis*, the experience of one is the experience of all. Take, for instance, the New York Central, the road which forms the nucleus of what is called the Vanderbilt combination. Seventeen years ago it was not in existence as a corporation. In 1853 it was chartered and grew into life out of the six separate links, not one of them seventy-six miles in length, which divided the three hundred miles of road between Albany and Buffalo. This corporation was again, in its turn, merged in 1869 into the larger New York Central and Hudson River Railroad Company, which controls within the State of New York but little less than a thousand miles of track and much more than \$100,000,000 of capital. The consolidation so far was perfect, and had taken place under a State charter and within State limits. Growth, however, did not stop here; the combination of capital simply adapted themselves to the form a political system. Beyond the limits of New York the corporation held, in the eye of the law, no property; it did not control a mile of track. At Buffalo, however, the Central connected with another company, itself made up of four separate primal links which had once connected Buffalo with Chicago, and which had united in obedience to the same law of development which had built up the Central. West of Chicago came yet other links in the trans-continental chain. Three lines competed to fill the gap which lay between Chicago and the eastern terminus of the Pacific road, —the Northwestern, the Rock Island, and the Burlington & Missouri River. In the autumn of 1869 the consolidation of the Central and the Hudson River took place. Immediately afterwards, at the annual election of the Lake Shore & Michigan Southern, the Vanderbilt interest took open possession of that corporation, controlling a majority of its stock. In May, 1870, it in like manner assumed control of the Rock Island and Chicago & Northwestern. The same parties in interest were now practically the owners of a connected line of road from New York to Omaha; there was no consolidation as yet, but, so far as the public and competing roads were concerned, the close of 1870 found the six parties which but a short time before had been in possession of the trans-continental thoroughfare reduced to three. Thus rapid had been the progress of consolidation—the irresistible law of development of the railroad system. The inference is inevitable. Seventeen years ago six roads divided the route between Albany and Buffalo, and in 1853 these were consolidated into one. Three years ago four roads connected New York with Chicago, and these four were then reduced to two. One year ago five roads divided among the distance between the Atlantic and the Pacific; six months ago these five were practically reduced to three. How long will it be before these three will be reduced to one? How long before consolidation, as yet confined to connecting, will extend to competing roads? It is perfectly useless to discuss the question whether this massing of wealth and of power is desirable or otherwise. It is sufficient to recognize the fact that it is inevitable; that it is a natural law of growth. Legislation could only wage a futile war against it; checked in one form, it would devise another; by indirections it would find directions out. It has been steadily going on from the beginning; it is now going on, and it is not likely to stop. No legislation can prevent it, even were such prevention desirable. Any attempt in this direction will but result in a recourse to subterfuge, and the practical reduction of law to a dead letter. You cannot prevent, but you may, by looking at facts as they are, not inefficiently regulate. How this can best be done is the problem.

One fact must be accepted to begin with—the railroad system has burst through the State limits. Already not a few corporations have carried their operations into half the States of the Union. Capital does not recognize the territorial divisions of a common country; nominally it may evade them, but prac-

tically it destroys them. Either through the machinery of different corporations, or through consolidation, one great moneyed or managing interest is destined at no distant day to own every mile of railway on a direct line from New York to San Francisco. In what must such an ownership inevitably result? It is not wise to attempt to deal with a too remote future; but in this instance the future is very immediate, and the question at issue involves some of the most delicate considerations connected with our federal system.

What is known as the doctrine of States' Rights—the invaluable centrifugal force of our political organism—fell into much unmerited odium through its abuse during the progress of the irrepressible conflict. It was and is a most useful and essential feature in our constitutional polity. The American people still hold it in strong affection, and cling tenaciously to State lines and State authority. Nothing which tends to obliterate the one or diminish the other is regarded with popular favor. This is particularly the case in view of the great and growing incompetence so manifest in the national Congress. Nothing that this body now has to deal with is treated in a large and comprehensive spirit, and its legislation is almost invariably composed of shreds and tatters. Thus the people do not look with favor on the prospect of yet other great and delicate interests devolving upon it. All this is true, but it will not avert the inevitable. It may be very unfortunate that our great lines of railroad should become national routes, but such considerations cannot control the fact; national routes they are, and as such they cannot much longer be organized or controlled under State laws. The Federal government must assume a certain degree of active jurisdiction as regards them, and that very shortly. The Constitution, under the clause authorizing Congress to regulate commerce between the States, clearly warrants such assumption. Under this clause Congress has always exercised a control over navigable rivers; but the commerce between the States is no longer carried on by barge or by steamer, but by rail. The question for the consideration of intelligent observers is no longer, then, Shall the national government assume this control? but, How shall it be exercised when assumed? During every session for years past Congress has trembled on the verge of legislation; a regulated railroad between Washington and New York being the alleged necessity. Everything that has gone upon the statute-book looking in this direction, like the Pacific Railroad business, or the land-grant system, has been of the most unfortunate character. Hitherto, however, nothing has been done which necessarily compromises the final result; no irrevocable step has been taken. That, when taken, it should be taken right, is of the last importance.

Besides the consolidation of connecting roads, another phase of the same gravitating movement was discussed at some length in this *Review* a year ago. In many of the States legislation has been directed against the consolidation of competing lines. Two years ago an act forbidding it was passed in New York, and more recently a provision to the same end has been incorporated into the Constitutions of Illinois and Michigan. It is wholly unnecessary to say that all such measures of State legislation are utterly futile—almost childish. These giants have some time since outgrown State swaddling-clothes. Even had they not the character of such legislation is most open to criticism. Certainty and responsibility in management are two of the most important requisites of a good railroad system. This is peculiarly the case in America, where almost our only machinery for the correction of abuses lies in the degree of concentration with which public opinion can be brought to bear in a given direction. If our people distinctly feel an evil and can be made to see that some one is responsible for it, there is no interest or combination of interests which can long resist the pressure. So far as railroads are concerned, competition puts both certainty and responsibility out of the question; it renders the first impossible, and, by dividing, destroys the last. A most conclusive illustration of this proposition, as well as the utter insufficiency of State legislation to deal with the subject, may be found in the experience of the last year.

The system of transportation of freight through the agency of what are known as the colored lines is now pretty generally understood. A large number of cars, colored red, white, or blue, according to the organization to which they belong, carry most of the through freight, in regard to which competition exists, from West to East. These cars, in some cases, belong to the railroad companies, and, in other cases, to individuals; in no case, however, do they operate for the companies individually, but for a combination, of which the particular company owning the cars is a member. This combination constitutes a copartnership of corporations, having its complete and separate organization of clearing-house, accounts, clerks, agents, and runners, carrying on operations all over the country, and forwarding freight in every direction. The profits of the business are divided among the roads or individuals of which the combination consists, on a basis established in advance. The combinations are, in fact, freight express lines. During the last year the competition between these lines, and consequently between the roads over which they were operated, was bitter in the extreme. The rates made East and West were simply ruinous. On certain descriptions of freight they literally were reduced to nothing, and cattle were carried over the Erie road at a cent a head, as against one dollar a car, the rate charged on the Central. On other articles the reduction was not so great, but both on passengers and goods rates were purely nominal, and hardly averaged a third of the usual amounts. Of course this could not last. Early in September representatives of the competing lines met in New York, and proceeded to put a stop to competition in the one way possible among monopolists—by combination. The parties in interest were the Central, the Erie, and the Pennsylvania rail-

roads. The competition was mainly from Illinois to New York. In both Illinois and New York laws forbidding the consolidation of competing lines were in force, and all the roads were carrying on operations in one or both of those States. At the meeting in question it was decided to "pool" the earnings of the colored lines to all competing points; in other words, all receipts from that business which was supposed to receive a peculiar benefit from competition, were to be paid into a common fund, competition was immediately to cease, fixed rates were to be charged, and thus, at last, all the great trunk lines were to be practically consolidated, in so far as the business community was concerned. This arrangement was agreed to, but broke down for the moment because of quarrels among certain of the individual contracting potentes. The two irreconcilables were Gould and Vanderbilt, who represented two New York roads; and yet the New York statute-book contained a recently enacted law intended to prevent and render impracticable any combination like the one agreed upon. Not being able to effect the desired arrangement there, certain of the same parties went to Chicago, in a State where a similar provision to that in force in New York had been made a part of the Constitution, and there they actually did enter into an agreement, under which all the roads between Chicago and Omaha "pooled" their receipts between those points, and this contract went into effect. Yet no law, no constitutional restriction was violated. No law, in fact, could be framed which would meet the case, and the solemn efforts to accomplish it were simply illustrative of the extreme ignorance prevailing among fairly intelligent men as to the practical limits of legislation.

The failure of the New York negotiation was, however, only temporary; the thing will be done, and, moreover, it is by no means clear that it is not best for the community that it should be done. In this combination at last will be found both responsibility and certainty. Rates will no longer vary with every season and to every city; points destitute of competition will not be plundered, as they now habitually are, that competing points may be supplied for nothing. During the last summer many towns in New England were charged upon Western freights heavily in advance of the sums charged for carrying the same freights on the same roads a hundred or two miles farther on. All because, through competition, the farther point was served at a loss to the carrier, and, therefore, the nearer had to pay the road profits for both, besides replacing the loss. The agents of the roads do not seek to deny this; they acknowledge and defend it. They say, and say truly: "We must live. If our through business is done at a loss (and they show that it was done for nothing), then our local business must pay for all." This was the case in New England. The cities of Central New York fared no better. During a war of rates, almost any manufactured article will be carried from the seaboard to the West for perhaps one-half of the amount charged for carrying the article there from a semi-interior point. So also as regards Eastern freights. Syracuse, Rochester, and the like class of cities can neither compete on equal terms with Boston in the markets of the West, nor with Chicago in those of the East. The discrimination against them is said to amount in certain cases to ten per cent. of the whole value of the article transported. Neither, under the existing system, is there any remedy for this evil, and a consciousness of this fact, of the risk to which they are continually exposed, has caused the breaking up of many manufacturing establishments at interior points.

Again, the element of gambling is not considered as an advantageous one in the transaction of business. To eliminate it, to equalize, to insure stability and an even operation of natural laws in trade, is one attribute of an advancing civilization and a chief result of science. Does not a sudden change in tariff—a change sprung on the community in an hour, ranging all the way from one hundred to fifteen thousand per cent. on all classes of freights—infuse an element of change into current transactions? Just this fluctuation took place in September, 1870. How, also, can the business community deal with certainty, or make orders or contracts, when to-day it may cost far more to send goods from Boston to Chicago than from New York, and tomorrow New York firms may have to ship their goods to Boston as the cheapest way of getting them to the West. Thus competition by rail, unlike that by sea, knows no law of supply and demand; there is always a given supply of machinery, wholly irrespective of the demands of trade. Here, then, is no certainty, no stability; a great evil exists; yet who is to be held responsible for it? Upon what point is public opinion to be concentrated? It cannot be on the system, for nothing of the sort in an organized form exists; neither can it be on individuals, for they clearly cannot control events, otherwise there would be no recourse to "pooling." The responsibility, in fact, is absolutely divided away; it does not exist.

States and legislatures will, doubtless, for some little while longer, cling to the idea of competition as regulating tariffs by rail, but it must break down in the end. The value of competition as affecting the regulating tariffs by railroad service lies in the superior quality of the service it exacts, the promptness, comfort, civility, and general regard to the wishes of the public. This is instantly apparent to any one who passes from the competing roads east of the Missouri on to the Central Pacific. These things no law can regulate, but competition does; the whole subject of rates, on the other hand, the law can, and ultimately must, regulate. Competition merely causes them to fluctuate wildly, according as an internece war or a combination to plunder may for the moment prevail.

A fixed *minimum* of railroad charges is no less essential to the community than a fixed *maximum*. One point or section or town cannot, on such a vital matter as transportation, be at the mercy of a competition which may exist to another. The moment it is, all stability and certainty vanish from industry. Such an

element of chance is worse even than the droughts and ice which affected carriage by water. How and by whom is this great business of transportation through monopolies to be regulated? One man cannot buy up Lake Erie or the Missouri, and drive away from their waters every boat not owned by him; yet channels more important to the trade of a continent than any lake or any river, no matter how large or how long, are now held in practical ownership by a few of the most notoriously unscrupulous men in the whole land, to be regulated as to them may seem good. Under the present *regime* they cannot even be held to a responsibility. That such a system should be permanent is the reverse of probable.

There only remains sufficient space to allude to one more subject in this connection. The power of these corporations in the hands of corrupt men as a disturbing and degrading influence in our politics, and the crying abuses so notorious in the internal administration of corporate affairs, have of late occasioned no inconsiderable degree of public solicitude. Examples of both descriptions of evil referred to are always on hand, and the year just past has been peculiarly prolific of them. Certain instances, however, pall by force of repetition; certain men succeed in acquiring a pre-eminence in infamy which actually destroys their value for purposes of illustration. The world grows weary of hearing them. The frauds and outrages in the Erie management, for instance, have, perhaps, been dwelt upon *nauseam*. Not that justice has been, or outside of a prison door, well can be, done to their perpetrators, but nothing implicating them can longer excite surprise. From the leading criminals themselves to the counsel who revel in their dirty work, these men have now brought all the discredit they can on everything with which they live in contact, from American credit down to the New York bar. It is, therefore, hardly worth while to go on with the contributions of another year to their bead-roll of offences. A new illustration from other quarters of the abuse of political influence would be more effective. Even if no evidence should be found to exist of the perpetration of fraud, yet the opportunity for it may exist so evidently—the way, if the will were only there—that the propriety of removing from erring humanity such an ever-present temptation may prove a subject worthy of grave discussion. Upon looking over the broad field, various scandals at once suggest themselves. The incidents of the recent Congress and its suspicious squandering of public lands would naturally be the first. Especially those vast grants which have endowed a single corporation—the Northern Pacific—with an appanage nearly equal to a dozen States of the size of Massachusetts, and hardly, if at all, falling short of the united areas of the five second-class European kingdoms of Denmark, Holland, Belgium, Portugal and Greece. At one time during the last winter there were railroad schemes pending before Congress which appaopriated four hundred million acres of the public domain—an area larger than the whole original thirteen colonies. Of the Southern States it would be mere waste of time to speak. Their railroad bond transactions command no confidence, and would not reward the trouble of exposure, however plentifully they might furnish the material of bitter satire. New York, its legislature, its courts, and its corporations, are, for reasons already given, outside the pale of discussion. The case here is conceded, and the \$5,000,000 check which the thoughtless Vanderbilt signed without a glance, as a mere detail in the business of a morning, is as inadmissible as are the unending wars of Colonel Fisk, or the experiences of Mr. Burt in the committee-rooms at Albany. Massachusetts next offers a tempting field, but perhaps on an insufficient scale. The Hartford and Erie proceedings were as gross an outrage on common honesty, and even common decency, as lawyer ever sought to palliate, or a venal lobby to sustain. That a corporation should waste its substance in stock-jobbing, and gamble away funds held in trust in operating for its direction's benefit in its own securities, is notable enough; that beyond all this, the same corporation should persuade a legislature to loan it yet other funds to replace those lost in the game of chance would seem incredible. Yet all this took place, and the veto power alone saved the honor of the State. Neither were the proceedings in New Hampshire devoid of interest. In that State the proceedings, both of the Executive and of the Legislature, strikingly illustrates the vicissitudes of corporate life. A President-Governor played for his railroad with its stockholders, and the Legislature was umpire in the game. These examples might be too local in their interest. Illustrations may equally well be drawn from larger corporations operating in more central sites; take, for example, the record of the Pennsylvania railroads in the Legislature of that State.

[The subject is here illustrated by an interesting exposition of the method by which the Pennsylvania Railroad Company last winter secured legislation by which the sinking fund of the State could be made available for the construction of new tributaries, and which only failed of success through the Governor's veto. This passage we hope to give hereafter.]

Three essential features in the growth of the railroad system have now been briefly referred to and illustrated the consolidation of connecting roads, obliterating State limits; the combination of competing roads, evading State jurisdiction; finally, the concentration under corporate control of a degree of wealth and influence greater than any existing machinery of State government can control. It is useless further to pursue this branch of the discussion. It might, perchance, be profitable to do so, were the difficulties, political and moral, which have hitherto been dwelt upon, met in any quarter with a denial. This, however, is not the case. If the conclusions were not obvious from the experience of other States, the outrages annually perpetrated, both by courts and Legislature, under the name of law, in New York, would place them beyond the need

of proof. In that State even the corporate system itself has broken down. The stockholder has no longer a voice in the management of the affairs of the corporation. The annual farce enacted in the Erie offices, when the *de facto* possessors of that thoroughfare go through the form of renewing their control over it, is an illustration in point. From whatever side the discussion is approached it leads to the same result. The existing railroad system, both internally and externally, as regards the legislature, the exchange, and the stockholder—as serving the community by competition or through combination, is in an unsatisfactory and dangerous condition. Materially it is a great success; that fact has hitherto enabled it to support its abuses, and may continue to do so for some time longer. A rapid change, however, is visible even to the least observant. Competition was the soul of our system; yet competition is steadily yielding to the desire for combination. The corporate principle has failed no less than competition, and the idea of management through representation has already given way to the one-man power. Regulation through State authority has proved the saddest failure of all, for the energetic whole can hardly be controlled by the incompetent government of a part. None of these propositions can be successfully controverted. It only remains, then, to pass to the other, and far more difficult, branch of the discussion. The remedy is to be treated of; the next phase of development is to be considered. The prospect of any great result attending the present effort in this direction is not brilliant; while, however, not much is likely to be gained through the attempt, little is jeopardized by it.

That the national government must then, soon or late, and in a greater or less degree, assume a railroad jurisdiction, is accepted as an obvious conclusion to be deduced from the irresistible development of the system in a course it has hitherto pursued. The next question is, when, and in what way, and to what extent, is this to be done? What is to be the basis of legislation? This now admits of almost infinite modification, ranging from public ownership on the one hand, to the most limited regulation on the other. The same may be said as to extent of jurisdiction. It may be assumed over all roads lying in more than one State, or it may be confined to certain trunk lines especially designated as military and post roads. These questions it is now premature to discuss. They constitute the final problem. All other proposed solutions of it, resting upon State regulation or State control, are but temporizing expedients, important simply as illustrating the practical value of certain theories. Such may prove instructive resting-places; they can hardly be the final objective. To these, however, attention should now be confined, for through them the ultimate results are to be evolved. Fortunately the national field is yet clear. The utter breakdown of all the existing State systems should at least be full of instruction to those who must build up a national policy. They will be hampered by no precedents, trammelled by no machinery, inadequate and yet existing, but they will be free to create a system both adequate to the needs of the age, and in conformity with the character of our Constitutions. It is a work which, in all probability, must soon be undertaken, and one which might well task the ability of a Hamilton. It is greatly to be hoped that, until some man competent to deal with it shall present himself and quietly assume the task, the present local chaos will be suffered to continue; otherwise we may all perchance find ourselves involved in some general muddle such as now exists in more than one locality. The preliminary difficulty in the case is very evident. It needs now to be stated with all possible emphasis, for it will continually present itself throughout what remains of this discussion, and must ever be borne in mind. The whole difficulty arises from the development of a material and moral power, or rather, perhaps, combination of powers, in our social organism which our political system was not calculated to deal with. At the time the framework of our government was put together, a system of necessary monopolies was the very last thing which was expected to present itself on this continent. Our governments, state and national, grew up among, and were calculated for, a community in the less complex stages of civilization. Our whole machinery looked to dealing with individuals, and that only in the least degree, which deserved the name of government at all. The idea of one man, or set of men, combining to own in absolute monopoly the great channels of internal communication as they then existed—the Hudson, or the Ohio, or the great lakes—would have been regarded as a wholly inadmissible supposition, a contingency impossible to occur. Consequently no provision was made for it. No machinery was devised calculated to meet such an improbable emergency. Yet that very emergency is now close at hand, if not already here.

To supply the national government with this supplementary power, to adapt it to the new exigency, in order that it may not break down under it, is, however, the work of the morrow, and will be final in its character; that of to-day is fortunately not conclusive, but of a tentative nature; this, in short, is the period of transition. The roads are not yet out of the hands of the States; it is through them that the preliminary work is yet to be done. Something is to be derived from their experience in the past; the rest must come from their experiments in the future.

The tendency of popular thought is now undoubtedly towards the ownerships of railroads by the community. The success of this system in Belgium, and the agitation in regard to it in England, and in certain portions of this country, make it eminently desirable that the experiment should be tried, if only with a view of testing a theory and giving a new direction to inquiry. The present is also a time peculiarly opportune in which to make the attempt, for it can now be essayed on a small scale, involving, at most, interests comparatively trifling. The result, as bearing on the final national problem, could not fail to be most instructive. It is impossible, in view of past experience, not to entertain grave doubts as to the result of any experiment of this sort,

made through the political machinery which exists in America. As regards the construction of a railroad system, it has repeatedly been tried and uniformly ended in failure. Pennsylvania, Ohio, Michigan, Illinois, and many other States, went through the same sad experience. Every section with us had its claims, and these claims could not be disregarded. "Log-rolling," and the legislative "truck and dicker," were rapidly developed into an intricate study and lucrative profession. In Belgium, in France, or in Russia, a government engineer can locate a railway, and it was found to be otherwise in America; and an impartial disregard of the figures of the census by no means resulted in a commercial success. It is, however, argued that it would be otherwise in the case of a completed system; that if our State governments could not construct, they could at least manage railroads. This remains to be seen. That the government should engage in any business, whether as producers, as carriers, as bankers, or as manufacturers, is opposed to the whole theory of strictly limited governmental functions. Whether it is possible to secure a board outside of politics which would manage our railroads with a shrewdness and zeal equal to that displayed by individuals, stimulated by the hope of gain, is only to be decided by experience. That experience we probably shall soon have. Should, however, the experiment succeed when attempted by a State, no conclusion could safely be drawn as to its results in a national form. The Federal government is peculiarly and obviously unfitted for any work of the sort—certainly until a thorough and sweeping reform of the civil service is effected. A purified political atmosphere may be imagined in which at some future time it would be safe for Congress to assume the management, through supervising boards, of certain designated continental routes; but any movement in that direction would certainly, and very properly, encounter a strong and determined opposition so long as the present condition of affairs exists, and could only result in increased corruption and commercial disaster. It is difficult, also, to see how even experiments at State management can succeed, except under most favorable auspices and on a very limited scale. They will inevitably be attempted, not on the local roads, but upon fragments of the great trunk lines. These no one State can wholly control. It can only possess itself of the fractional portion of the whole within its own limits. This cannot answer the requirements of the community, which distinctly demands a correction of the abuses existing in the main thoroughfares. Here is where the difficulty lies. Local lines can scarcely be purified and controlled, while the through lines are amenable to no law. Any effective reform must be tested in its application to these last, and these are already beyond State jurisdiction. While, therefore, an attempt of State ownership could hardly fail to be of great illustrative value, there are probably other directions in which experiment could more usefully be tried.

A safer solution of the difficulty may not improbably yet be found in effective regulation, than in State ownership. This last looks to the destruction of the principle of private corporate life as the basis of the railroad system, and to the adoption of the whole of it into the body politic. Regulation, on the other hand, proposes to have the government, while preserving the separation between the body politic and all private industry, yet exercise an active control over its own creations. This is the tendency of legislation in many of the Western States, where the results of government meddling are still fresh in the popular memory. Foremost among these States is Illinois. In the remarkable Constitution just adopted there, the great principle is for the first time recognized that the railroad system is exceptional among all industrial pursuits, and must be recognized and dealt with as such. This in itself is an immense stride in advance. It is the concession of a starting-point, the recognition of that new social and political force for which no provision had been made. When a deficiency is fairly acknowledged, we can, in America, feel a tolerable confidence that it will shortly be supplied. The provisions introduced into the Illinois Constitution are, indeed, crude and unsatisfactory, but they are a beginning, and they at least indicate vigorous minds at work upon the subject in the Northwest. A discussion of these provisions would bring into view at once the very point upon which our State systems have hitherto broken down in their attempts to deal with the railroad development. The probabilities are enormous, also, that the national system, whenever it takes the form of law, will break down on that same point.

The one striking feature of the Illinois Constitution is the strong resolve of its framers to do away with what are known in England as "private bills," and in this country as special legislation. It is unnecessary to dilate upon the nature of this abuse, which may safely be set down as the greatest danger to which any system of government is liable; it may almost be said to be the root of all political ills. Legislation should know nothing of individuals. All modern thought tends to the conclusion that the universe is controlled by general laws; and the belief in special providences is entertained only by the most superstitious. A sound system of government should recognize individuals no more than the laws of nature recognize them. The law should apply to all, without discrimination for or against. The system of special legislation, on the contrary, from top to bottom, is based on a supposed necessity, which is taken for granted as existing, that privileges may be conceded to one or few which it is not safe or politic to concede to all. Nature never acts in this way, nor will thoroughly enlightened governments do so, when any such exist. The Illinois Constitution deserves to be hailed as a great advance towards the realization of this idea.

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Now, while it is conceded that special legislation is the bane of all government, it must also be conceded that special legislation has hitherto been found indispensable to any regulation of the railroad systems.

The exception once conceded, every railroad came up and demanded its own special immunities and privileges—its peculiar charter, which was a law unto itself. The extent to which this was carried may be inferred from the three thousand two hundred acts on the statute-books of Great Britain, and the one thousand on that of Massachusetts—nine-tenths of them, in each case, special legislation to meet the supposed requirements of an organized monopoly. The exception and its dangerous nature—the frauds which were perpetrated under it, and the lax and confused system of legislation it was engendering—long ago attracted the public attention and excited its alarm. The press raised its voice, and the people responded by inserting into more than one Constitution provisions absolutely inhibiting the passage of any act of a private nature. In other States the Executive accepted the issue; and in New York a long succession of vetoes has only recently vindicated the principle of general legislation. There was in each of these efforts at reform an element of fatal weakness. The fact that the railroad system occupied an exceptional position was ignored. Instead of conceding that this system was made up of a number of monopolies, in regard to the necessities of which a discretion must be exercised, journalists and legislators insisted on placing them in a position exactly similar to that of individuals—amenable to every law of trade. The result was, of course, failure. The monopolies evaded or broke down the law, and were omnipresent in legislatures. There was no machinery in the government adapted to meeting the exceptional case. Reformers failed to realize that, though special legislation was corrupting the whole political system, yet general legislation of the ordinary description would not meet the requirements of the case. It is here that the whole question lies in a nutshell,—how can the requirements of the railroad system be met, and yet its individual members driven from the legislatures? A means to this end once discovered and incorporated into the general law, and the most difficult part of the railroad problem is solved.

This final result is not attained in the Illinois Constitution; had it been, the value of that instrument would have been more than doubled. Indeed, the provision made in it brings the Innovator just to the fatal point; as yet he has done nothing, but the next step involves everything. In spite of its Constitution, Illinois must now slip back into the deep mire of special railroad legislation, or it must go on and solve the problem. The case stands thus: the Constitution implies the passage of (1) laws prescribing reasonable rates of charges on the different railroads, and (2) laws to correct abuses and prevent unjust discrimination and extortion in the rates of freight and passenger tariffs.

The Legislature, it seems, is to do this work; if so, the work cannot be done; the provision is so much waste paper. It may boldly be laid down as a principle, that no general law can be framed which will meet the exigencies of a whole railroad system in all its manifold details. This is true in almost every respect. A law, for instance, authorizes the taking of land for railroad purposes, but one road requires an exceptional amount of land in a particular locality. A general law regulates station facilities; but while it may apply well to one district, it will be simply ridiculous in its application to another. Finally, take the case of a general law regulating fares and freights—the very one provided for in the Illinois Constitution. All the members of a railroad system do not exist under the same conditions as to population, traffic, and cost of construction and of operation. Of two roads aggregating the same gross annual receipts, the one will earn nine-tenths of the whole by carrying freight, and the other the same proportion by transporting passengers. One road runs across a thickly peopled table-land, crowded with manufacturing villages; another climbs mountain ranges and drains a poor agricultural region. Can one general law, regulating fares and freights, be framed so as to apply to all of these differing conditions? The proposition conveys its own negative. A general law calculated to affect all the members of a system must be adapted to the capacity of the weakest member of the system. So of this law, the incubation of which seems to be imposed upon the Illinois Legislature—a general law limiting fares and freights, which will allow the weakest road in the State to live, will be no limitation at all upon the stronger roads—what is a famine to one is a feast to another. If, turning from this manifest absurdity, the legislature seeks to establish tariffs adapted to particular roads, then the whole evil of special legislation, in its worst possible form, is upon it. Where, then, is the escape?

We have thus got back to the old puzzle—how to meet special requirements under general laws. The solution, if found at all—if failure is not predestined—will be found by the Illinois Legislature in fairly recognizing an evident exception to general conditions, and supplying an executorial power specially calculated to meet it. It is the want of this which has brought to naught all efforts at general legislation on this subject up to this time. They have uniformly failed from one defect; they were hard, unyielding, intended to apply to differently conditioned members of one exceptional and most complex system, and yet wholly unprovided with any discretionary, adaptive, or executorial power. The law was there, but it did not move. It was as if a criminal law were put upon the statute-book which was to apply to all degrees of crime indiscriminately, without the aid of judge or of officer. And, indeed, this very example illustrates the whole subject. Let us follow out the whole parallel. The criminal law was once a subject of special legislation. Individual criminals had acts passed to meet their particular cases. The Legislature was at one and the same time judge and jury. The legislative and judicial functions of government were, however, separated so long ago, that the community has forgotten that they were ever united; yet it was this division, first introduced under Alfred the Great, which alone made possible the success

of parliamentary government. Had it been the discovery of one man, he who made it would have deserved to rank among the greatest benefactors of his kind. In early New England history the distinction was again obliterated. The Great and General Court, was in Massachusetts Bay, both the source of law and the seat of supreme justice. This simplicity very shortly disappeared as society became more complex, but it left behind it the fatal legacy of special legislation. The same confusion of functions is exactly what has hitherto existed in regard to railroads; the result, both in New and Old England, is seen in a statute-book swollen with special enactments, a legislature overwhelmed with business it cannot do and tainted with jobbery of which it cannot rid itself, all resulting in a railroad system which is a confessed failure in everything but its material aspect, with which the legislature can have nothing to do. Can the desired separation be effected?

The solution of the problem stated in this form seems so obvious, that it is fairly a matter of surprise that it has never yet been practically attempted. The legislature should enact its general laws for the requirements of railroads, as it does to meet the innumerable civil and criminal complications which arise; but, in the one case, as in the other, the judicial and discretionary action under the general law should be devolved upon tribunals especially created to take cognizance of them. The legislature declares the rule which is the same to all; but the degrees of discretion which varying circumstances exact in the application of the rule must constitute a trust necessarily delegated to others. At present all these distinct powers are jealously retained by the legislatures. Their committees sit as courts, and take evidence, and listen to arguments. So far it is well. At this point, however, instead of framing a general law or dismissing the individual case, they undertake to give a charter to this applicant and to refuse it to that; to pass a special act in favor of this corporation, and to reject it as regards that; to authorize an increase of stock here, and to direct the construction of a new depot there. These are functions which no legislative body can successfully perform; as well undertake to decide every suit at law, or to affix the penalty to every crime. Just so long as legislatures insist on themselves doing work of this nature, just so long will corruption increase and the statute-book fall into confusion.

Let us now apply the test to the other principle, that of general legislation, and suppose the strict rule in regard to it incorporated into the constitutions. The exceptional character of the railroad monopolies must also be acknowledged, as has been done in Illinois and Michigan. The legislature then enacts its general laws imposing regulations; and, where conditions would evidently vary and the exercise of a discretion by some one be incumbent, in all of these cases, instead of hearing each party through its committees, and trying to resolve itself into a jury some hundred strong, it would define, as in the criminal law, the limits within which the discretion must be exercised, and refer all questions which may then arise to the tribunal created to deal with them. Take, as an example, all questions of construction or of granting the right to condemn land. The law would, in general terms, lay down the conditions and limitations governing in such cases, and the corporation would be referred to the proper tribunal to see that those conditions existed or that the limitations were observed. So of depot facilities and of accommodations to the public.

The crucial test, however, will be found in the case of freights and fares. How could any tribunal be empowered to regulate these? This, too, is perfectly feasible. Railroad corporations are often spoken of as trustees for the public; they may more properly be regarded as lessees. They receive from the community the monopoly of a proposed thoroughfare; the consideration they pay for this estate is the transportation over it, under certain conditions, of all persons and property that offer. How to regulate those conditions, which, in fact, fix the considerations rendered to the community by the monopolist for the enjoyment of his grant, is the point now at issue. Hitherto these conditions have been left to fix themselves; the lease has been a perpetual one, at a nominal rent. As the monopolist saw fit to reduce his tariff, by so much he raised the rent he paid; he did more work for less pay, for his rent is always in kind—in work done. As he put up his tariff, he lowered his rent; he did less, and the community paid him more. Thus, practically, as long as he could vary his rates he fixed his own rent. This must continue to be the case just so long as railroads are controlled by private parties, if legislatures undertake to settle these conditions themselves.

The ownership of the railroads by the State is one solution of the difficulty, revolutionary in nature and doubtful in result. Another remedy is now sought. To return to the simile of the lease. These leases have hitherto been in perpetuity; leases are not generally so made. They usually fall in for revision at the end of a term of years, and are then either renewed on terms acceptable to both parties for a new term of years, or, in the case of ground leases, if no terms can be agreed upon, the landlord pays for the improvements on an agreed basis, and resumes possession of the property, to let or to hold, as seems to him good. Apply this simple and familiar process to railroads. A general law regulates as nearly as may be the nature and limits of tariffs to be imposed upon and accepted by railroads. All discretion within those limits, made necessary by peculiarities of condition arising out of business, construction, etc., must be devolved on the proper tribunal. Within those limits it is authorized to bind the State to the corporation for a limited term of years, subject to renewal on a revised valuation. The rest is a simple matter of an ordinary lease.

It cannot be said that this plan is complex or difficult to understand, for it is but applying the daily business arrangements of individuals to the transactions of a

State. Two objections, however, may be made. It may be said that it is novel. To a degree this is true. No single feature in it is novel, but there is a combination of the Belgian, English, and American systems, in order to arrive at something adapted to the needs and peculiarities of our social and political condition. Tariffs of rates, incorporated into charters and specially adapted to particular routes, are familiar enough in England and France; they are not unknown in this country, but the entire inability of popular bodies like our legislatures, to deal with the very complex considerations involved has prevented their general adoption. In England those framed by Parliament have not proved satisfactory; in Belgium the legislature delegated the labor to an official with more satisfactory results. The principle of limited terms is not new; the only novelty, if there be any, lies in the machinery provided, through which to bring the tariffs up for periodical revision.

But it will be said, Who will guard the virtue of the tribunal? Why should the corporations not deal with them as with the legislatures? They may do so, but somewhere and at some point, put on all the checks and balances that human ingenuity can devise, we must come back and rely on human honesty at last. One rule always holds good—where the most direct responsibility exists, there will be the best conduct to be found. Corruption loves a throng and shrinks from isolated places. To divide responsibility is to destroy it. The judges of our courts are rarely otherwise than pure; the heads of our official departments are conspicuous for honesty; they are always directly and individually responsible. If we thus can, and, indeed, from the necessity of the case, must confide the charge of the public funds and of personal liberties to mortals like ourselves, acting under the law, it is difficult to see why, except that we never have done so, we cannot trust these other interests to similar mortals. All in such cases depends upon the men. We have had in England and in this country a sufficiency of feeble attempts in this direction—boards of trade, railroad commissions, and various other pieces of machinery. They have all failed, for one reason—the principle of special legislation was ever kept open in the background behind them. They have uniformly possessed a mere simulacrum of power; their decisions were appealed from, their recommendations were ignored, and their principal duty was to sit patiently by and watch the corporations as they dealt directly with the legislature over their heads. Instead of the legislature saying to the sturdy corporation beggars who infested the lobby, as it would say to civil litigants or to criminals, "Leave us! there is the general law and there is a tribunal specially charged with the interests of you monopolists; go to it!"—instead of this, the boards, commissions, and what not, have ever been placed in the ignominious position of a court, whether civil or criminal, from which in every case an appeal would lie to the legislature itself. A tribunal so constituted can hardly fail, soon or late, to sink into contempt; least of all is it calculated to deal with powerful corporations. As a direct consequence of this conspicuous distrust, these tribunals have almost invariably been made up of every inferior and, not seldom, corrupt men, for no such responsibility and prominence was thrown upon them as forced out capacity and integrity as the only alternative to failure. Had the same class of appointees, as a rule, been placed upon the bench, the judiciary would long since have sunk into contempt. The duties, the responsibilities, and the characters of those composing these boards should, on the contrary, be brought up to the highest standard—to an equality, in short, with those of the judges of our courts. Their tribunals should be clothed with all necessary powers and be put forward as if the members were fully competent to represent the interests of the State with an experience and ability, a knowledge of details, and a zeal in their occupation equal to that ever so conspicuously displayed by the agents of the corporations. Such men could certainly be found; the corporations always have them. Meanwhile the whole subject may be summed up in few words; under a system which permits special legislation, boards for the regulation of railroads are useless; they are, however, indispensable under one which confines itself to general laws.

It is impossible that the defective machinery in our government, to use once more the simile so often employed in this paper, may be strengthened in the way indicated. A new strain has been brought to bear. At present our government occupies the impossible position of a wooden liner exposed to the fire of modern artillery. It was built for no such trial. The railroad corporations, necessarily monopolists, constitute a privileged class, living under a form of government intended to inhibit all class legislation. We must, then, see our government fail in this unexpected crisis, or we must strengthen it in such a manner as to enable it to vindicate its authority. This can only be done through human agency; ingenious statute machinery, without a man inside of it, will only result in certain failure. The other course, also, may fail, as the iron plates of our monitors may be crushed by the weight of novel projectiles; but here, at least, the power of resistance can in some degree be proportioned to the intensity of the strain.

A new work is before those vigorous intellects who, from the editorial rooms of Chicago, inspired the late Illinois Convention. They must now take the next step, or they have made no progress. They must inspire the Legislature to complete the work which the Convention left unfinished. It is a case of all or nothing. Should the Illinois Legislature undertake to deal otherwise than by general laws with the innumerable discretionary questions involved in every railroad system, then, in so far as the present discussion is concerned, the new Constitution is a predestined failure. Should it, however, carry on the work in an intelligent spirit; should it do, what has never yet been done in America, create an able and experienced tribunal to stand between the commu-

nity and its railroads; should it clothe this tribunal with all necessary power and dignity, and delegate to that discretion, necessarily left somewhere, in the application of general laws to monopolies; should it declare its decisions final on all points upon which no appeal lay to the courts of law by constitutional right; should it then sternly refer its railroad corporations to this tribunal, and bid them wholly begone from the lobby, or to come there only as petitioners for general legislation; then, when all this is done, and not until that time, shall we know whether anything is to result from the Illinois experiment. The whole country cannot but watch it with eager curiosity. It is the one alternative, with State ownership as the other. The national question is impending. The whole of that legislation, on which so much in the future depends, is yet to be initiated. It may well depend upon the experiment in Illinois whether this, too, of which all might now be hoped, is not to wallow into the slough of special legislation. It has many times been on the brink of so doing. Should this once happen, the machine is too cumbersome, and the interests involved too enormous, for us soon to extricate ourselves. It is in this regard, in its bearing on the final problem, that each experiment now assumes its value. Out of many failures will come the one success. Illinois, for the present, must deservedly attract the greatest degree of attention. That great State has first recognized in her constitution the magnitude and exceptional nature of the problem. Under that constitution she should not fail to be the first, seriously, thoughtfully, perhaps successfully, to grapple with it.

Baron von Weber's Experiments on the Stability of Permanent Way.

[CONTINUED FROM PAGE 341.]

The general deductions drawn by Baron von Weber from all the experiments relating to question *g*, namely: "What force is required to draw the spikes out of the sleepers?" are as follows:

1. That the force, in pounds, required to draw out of the timber rail spikes of the usual form—that is to say, square prismatic spikes with chisel points—is to be found, if the strain acts directly in the direction of the axis of the spike, by multiplying the area of the surface of the spike in contact with the timber by the following numbers:

For $\frac{1}{4}$ in. $\frac{1}{4}$ in. per square inch of surface of the oak 300 lbs. $\frac{1}{4}$ in. driven portion of the spike.
" 600 lbs. $\frac{1}{4}$ in. driven portion of the spike.
" 47 lbs. $\frac{1}{4}$ in. per square centimeter of surface.
" 94 lbs. $\frac{1}{4}$ in. of the driven portion of the spike.

If, however, the force acts laterally as well as in the direction of the axis, as is generally the case in practice, the multipliers become as follows:

For $\frac{1}{4}$ in. $\frac{1}{4}$ in. per square inch of surface of the oak 160 lbs. $\frac{1}{4}$ in. driven portion of the spike.
" 270 lbs. $\frac{1}{4}$ in. driven portion of the spike.
" 25 lbs. $\frac{1}{4}$ in. per square centimeter of surface.
" 42 lbs. $\frac{1}{4}$ in. of the driven portion of the spike.

2. That spikes driven into a sleeper for the second time, after the holes in the timber have been filled up, offer, at first, greater resistance than spikes driven into new sleepers.

3. That but very small forces are required to produce a widening of gauge to the extent of 6 or 10 millimeters (0.236 in. or 0.304 in.), as such amounts of widening are within the limits of elasticity of the structure, and require no loosening of the fastenings.

4. That a lateral pressure of 80 centners ($-9,075$ lbs.) at the most, acting against one point of the head of the rails, is sufficient to produce either a canting or lateral displacement of the rails to such an extent that the structure at this point is completely and permanently loosened.

5. That the force required for the further spreading and final destruction of the structure is much less than that necessary for the first loosening, the former being seldom more than 75 per cent. of the latter.

6. That the resistance of the structure to a pressure acting against one point of the head of a rail does not increase in direct proportion to the number of sleepers to which the rail is fastened, but that the elasticity of the rail and consequent torsion permits the fastenings upon the several sleepers to be loosened successively. The resistance of the rails to torsional strains may, however, enable the fastenings at any one point to receive such support from the adjoining fastenings that the resistance to canting at that point may be about doubled.

7. That if the elasticity of the rails is very great, a widening of the gauge to the extent of 25 millimeters (-0.984 in.) may be produced without remaining permanent, or without showing signs of having occurred after the pressure has been removed. This is more likely to happen if the widening of the gauge is produced by the canting of the rails than if it is due to their lateral displacement on the sleepers; in the latter case the displacement of the fastenings would be visible, whilst in the former a slight raising of the spikes in the direction of their axes could only be observed under favorable circumstances.

8. That in the case of structures having the joints of the two lines of rails arranged opposite each other on the same sleeper, the points at which the joints occur offer considerably less resistance to a widening of the gauge than is the case when the rails are disposed so as to break joint, the proportionate resisting powers in the two cases being about as 7 to 10. Thus a permanent way having the joints of the two lines of rails opposite each other, has as many points as there are joints at which the lateral stability or power to resist widening of the gauge, is but 7-10ths of that at the joints of a structure having the rails disposed so as to break joint. This is of importance with respect to accidents originating from a widening of the gauge.

9. That the application of bedplates between the rails and sleepers increases—under otherwise equal circumstances—the power of resistance of the structure to lateral displacement of the rails; but that the loosening of the fastenings takes place with a smaller displacing movement.

10. That as regards the power of resisting lateral displacements which are not permanent, and which are not of so great an amount as to render the structure unfit for traffic, the mode of placing bed-plates under the rails is of no importance; but that by placing these plates so that the greater number of spikes may be on the inside of the rails, the resistance of the structure to total destruction is increased.

We now come to the experiments relating to question *h* (vide page 343), namely: "What force is required to overcome the total resistance due to the combination of the holding power of the spikes in the sleepers and the friction between the rails and wheels?" Considering the moderate forces which, according to the results of the foregoing experiments, are sufficient to displace laterally the heads of the rails of a well-constructed and well-laid line to such an extent as to render it unfit for practical use, and taking into consideration, also, the great lateral pressures to which the heads of rails are subjected by the horizontal oscillations of heavy locomotives with short wheel bases, it becomes evident that the power to resist these latter forces is not that due to the mechanical structure of the permanent way alone. In fact, although there are great difficulties in determining with any degree of accuracy, either by theoretical investigation or experimental research, what the amounts of the lateral forces due to horizontal oscillation of the rolling stock really are, yet ordinary mechanical sense—if we may use such a term—tells us that they must frequently greatly exceed a pressure of 50 cwt., a pressure which the experiments already recorded prove to be more than sufficient to produce great distortion of the lines. Under these circumstances, therefore, it becomes evident that the stability of the structure depends in an important degree upon the friction between the wheels of the vehicles and the rails, and that between the bases of the rails and the sleepers. By means of the first mentioned friction, which can rarely be less than one-seventh of the load on the rails, the axles are enabled to act, to a certain extent, as ties between the heads of the rails, thus materially increase the resistance of the latter to being canted laterally; while, on the other hand, the friction between the bases of the rails, and the sleepers must necessarily, from the nature and state of the surfaces, be considerable, and must increase to an important extent the resistance of the rails to lateral movement.

As Baron von Weber remarks, the stability of a permanent way structure is only of value when the structure is being traversed by an engine and train, and thus the practical stability is that due to the holding power of the fastening, plus that due to the frictional resistance just mentioned. To determine, then, the amount of this total or practical stability, Baron von Weber carried out the series of experiments which we are about to describe; these experiments being made on a length of line of the same structure as that on which the experiments without loads were made, the sleepers being of the same age, the rails of the same make, and the spikes of the same size and shape. The experiments were made by placing on the line a vehicle, the load upon the axles of which was exactly known, and then arranging the hydraulic press employed in the previous experiments so that it exerted its pressure against the rails at a point as near as possible to that at which the wheels touched the latter. The power required to produce displacement was thus evidently that necessary to overcome the combined frictional resistances and the holding power of the fastenings.

39th Series of Experiments. These experiments were made merely to test the stability of the selected length of permanent way when unloaded. The results were as follows:

Pressure applied. Widening of gauge. centners. lbs. mil. in. 10—1,134. 4.0—0.157 20—2,269. 9.0—0.314 30—3,403. 16.0—0.629 40—4,537. 22.0—0.866 60—5,672. 31.0—1.220 55—6,239. 44.0—1.723

With the last-mentioned pressure the structure was completely loosened.

40th Series of Experiments. In this series a four-wheeled truck was placed upon the line, each pair of wheels of this truck imposing a load upon the rails of 145 centners—16,448 lbs. The hydraulic press was applied to the rails, as closely as possible to the point of contact of one pair of wheels, and the results were as follows:

Pressure applied. Widening of gauge. centners. lbs. mil. in. 10—1,134. 1.5—0.059 20—2,269. 1.5—0.089 30—3,403. 3.0—0.118 40—4,537. 4.5—0.177 50—5,672. 6.0—0.236 60—6,206. 9.0—0.354 70—7,940. 12.5—0.413 80—9,075. 15.0—0.512 90—10,210. 18.0—0.610 100—11,344. 21.0—0.690 110—12,478. 24.0—0.866 115—13,045. 26.0—1.043 130—13,618. 31.0—1.220 95—10,777. 34.0—1.338

When the pressure of the hydraulic press was removed, the elasticity of the rails enabled them to overcome to a certain extent the friction between their heads and the wheels, and caused them to return within 13 millimeters of their original positions, while this displacement became reduced to 3 millimeters when the truck was removed from the point against which the press had acted. According to these experiments the proportion between the loads required to produce similar displacements in the unloaded and loaded structures respectively were as about 5 to 9. Baron von Weber observes that, taking in the above experiments, the coefficient of friction between the wheels and rails as one-fourth the load (both rails and wheels being dry) we get a resistance due to friction, equal to 36.25 centners, which added to the resistance of the unloaded structure give values corresponding very nearly with those observed in the experiments on the structure when loaded. For instance, a widening of the gauge to the extent of 31 mil. was produced in the un-

loaded structure by a pressure of 50 centners, and adding to this 36.25 centners as the theoretical resistance (on the assumption of the coefficient of friction above mentioned) of the loaded structures, while the actual resistance, as shown by experiment, was but 3.75 centners greater.

41st Series of Experiments. In this series of experiments a shunting tank engine was placed on the structure, this engine weighing 559 centners ($-62,500$ lbs.), distributed as follows: on driving and trailing axles each 220 centners ($-24,960$ lbs.), and on leading axles 119 centners ($-12,580$ lbs.). The press was arranged so that it acted against the heads of the rails at a point distant 4 in. from the point of contact with the driving wheels, and the results were as follows:

Pressure applied. centners. lbs.	Widening of gauge. mil. in.	Structure loaded with 480 centners.
10—1,134.	1.5—0.059	5.0—0.118
20—2,269.	1.5—0.089	8.07—0.148
30—3,403.	3.0—0.118	11.0—0.177
40—4,537.	4.5—0.177	14.0—0.236
50—5,672.	6.0—0.236	17.0—0.394
60—6,206.	9.0—0.354	20.0—0.512
70—7,940.	12.5—0.413	23.0—0.566
80—9,075.	15.0—0.512	26.0—0.666
90—10,210.	18.0—0.610	29.0—0.766
100—11,344.	21.0—0.690	32.0—0.846
110—12,478.	24.0—0.866	35.0—1.043
115—13,045.	26.0—1.043	37.0—1.220
130—13,618.	31.0—1.220	42.0—1.390
95—10,777.	34.0—1.338	45.0—1.496

After the removal of the engine, and the withdrawal of the pressure, there remained a permanent displacement of the rails of 6 millimeters (-0.236 in.), of which 3 mil. was due to the bending of the rails between the coupled axles. It will be seen from the above results that whereas the widening of the gauge of the unloaded structure to the extent of 31 millimeters was effected by a pressure of 50 centners, it requires a pressure of 90 centners to produce the same displacement when the structure was loaded with 145 centners, and a pressure of 120 centners when it was loaded with 220 centners. Baron von Weber remarks that this last pressure differs from the amount given by the theoretical investigations, to the extent of 15 centners; but this difference may, of course, be simply due to a greater coefficient of friction between the rail and wheel.

42d Series of Experiments.—In order to ascertain the extent to which the canting of the rail in the foregoing experiments had been resisted by the holding power of the inside spikes, or to find whether the friction of the rails upon the sleepers, plus the resisting power of the outside spikes, had served to keep the rails in position, the inside spikes were loosened upon one length of rail, which was next submitted to experiments. The resisting power of this length of structure, *per se*, depended chiefly upon the fish-plates at the ends of the rails, and resistance of the latter to torsional strains, and in order to ascertain the amount of this resistance, the structure was first tested in an unloaded state. A heavy goods engine—having its weight distributed so that there were 240 centners ($-27,236$ lbs.) on each of the two pairs of coupled wheels, and 160 centners ($-18,150$ lbs.) on the leading wheels—was then placed on the structure, and the hydraulic press was arranged so as to act against the heads of the rails midway between the points of contact of the latter with the coupled wheels. The results obtained in these tests of the loaded and unloaded structure were as follows:

Pressure applied. centners. lbs.	Widening of gauge. mil. in.	Structure loaded with 480 centners.
10—1,134.	9.0—0.354	0.0
20—2,269.	13.0—0.512	0.0
30—3,403.	14.5—0.571	1.5—0.059
40—4,537.	16.0—0.629	2.0—0.079
50—5,672.	22.0—0.866	2.5—0.177
60—6,206.	25.0—0.984	4.5—0.236
70—7,940.	31.0—1.220	6.0—0.394
80—9,075.	44.0—1.723	9.0—0.512
90—10,210.	54.0—2.390	10.5—0.413
100—11,344.	64.0—2.590	13.0—0.512
110—12,478.	64.0—2.590	15.0—0.591
120—13,618.		

The permanent displacement of the unloaded structure was 13 millimeters (-0.511 in.), and that of the loaded structure 6 millimeters (-0.236 in.), which was due to the bending of the rails between the points of contact with the wheels. The outside spikes showed, in both cases, but an insignificant displacement, this displacement amounting to but 3 mil. at a point where the pressure acted.

The trials just recorded are, as Baron von Weber justly observes, very instructive, for they prove that the friction between the rails and the sleepers, plus the resistance of the outside spikes, is sufficient to keep the rails in their places, even when the pressure against the heads is such as to cause the canting of the rails to an extent sufficient to render the line unfit for traffic. The experiments also show that the inside spikes afford proportionately little resistance, and that they represent the weakest points of the structure. In fact, the fastened and loaded rails showed, under the influence of the same displacing power, displacements which were certainly not less than those obtained in the case of the structure in which the inside spikes had been loosened.

43d Series of Experiments. Nothing now remained connected with this part of Baron von Weber's investigations but to collect facts showing the influence of the state of the surface of the rails upon the stability of the structure. It might have been assumed, *a priori*, that that portion of the stability of a structure which depended upon the friction between the wheels and rails would decrease proportionately as the coefficient of friction was reduced; but Baron von Weber nevertheless considered that the labor of determining this proportionate loss of stability by experimental research would not be thrown away.

Under these circumstances the tank engine used in the 40th series of experiments was placed upon the line of rails with loosened inside spikes, and the hydraulic press was made to act against the head of the rails midway between the coupled wheels. In the first place

the rails, although free from sand or dust, were thoroughly dry, and rather rough, and the displacements obtained under these circumstances were measured. The engine was then removed, and the rails thoroughly greased with tallow, after which the engine was replaced, and the press applied as before, the displacements being again measured. The results obtained under these different circumstances are shown in the subjoined table:

Pressure applied. centrs, lbs.	Widening of gauge.	
	Dry rails.	Greased rails.
10—1,134	0.0—0.0	1.5—0.059
20—2,269	1.5—0.059	3.0—0.118
30—3,403	2.2—0.087	3.7—0.146
40—4,537	3.0—0.117	4.5—0.177
50—5,672	4.5—0.177	6.0—0.236
60—6,806	5.2—0.203	7.5—0.295
70—7,940	6.0—0.236	9.0—0.354
80—9,075	7.5—0.295	9.7—0.392
9—1,210	8.2—0.323	10.5—0.413
100—11,344	9.0—0.354	13.0—0.512
110—12,478	10.5—0.413	14.5—0.571
120—13,612	13.9—0.512	22.0—0.866

The outside spikes showed no displacement in either case, and in both cases the rails returned, after the removal of the pressure, to within 1.5 millimetre of their original position. With their surfaces greased, the rails completely canted with a continual pressure of 120 centners.

It may be assumed, on account of the roughness of the rails used, that the greasing of the rail surfaces produced no greater influence upon the coefficient of friction between the rails and wheels than as shown by the results above recorded, namely, a reduction of the coefficient from one quarter to one-sixth; and this being the case, the supposition is admissible that the theoretical conclusion already stated is correct, or in other words, that that portion of the resisting power of the structure due to the connection between the wheels by their axles, simply increases or decreases in proportion to the coefficient of friction between the rails and wheels. But it may be further concluded, on account of the great reduction of the coefficient of friction between rail and wheel caused by snow, sleet or a thin layer of ice, that under certain circumstances liable to occur in practice, the additional stability of the structure due to the cause just mentioned may be reduced almost to nothing.

A third and important conclusion may also be derived from these experiments, and this is, that when by longitudinal oscillations the load on the leading or trailing axles of locomotives is much reduced,* the power of the rails to resist forces acting laterally is also reduced, and this reduction may in fact become so great that the resisting power of the structure may depend solely upon the fastenings and fish-plates—sources of resistance which have been shown, by the experiments we have recorded, to be inadequate to resist alone such pressures as the lateral oscillations of the vehicle may produce.

The deductions made by Baron von Weber, from the experiments relating to the question (h): "What force is required to overcome the total resistance due to the combination of the holding power of the spikes in the sleepers and the friction between the rails and wheels?" are as follows:

1. That the resisting power of the rails to lateral forces is considerably increased through the friction between the wheels and rails, this friction causing the axle to form a kind of tie between the two rails.

2. That if the load upon the rail is more than 80 centners (—9,075 lbs.) per wheel of vehicle, the resting power of the rails to canting due to the friction just mentioned is greater than that due to the spiking of the rails in the ordinary way to fix sleepers.

3. That the resistance of the rails to lateral displacement on the sleepers is increased by the load on the rails in the proportion of 0.33 of that load; whence in the case of rails carrying a load of 60 centners (—6,806 lbs.) per wheel the resistance of rails lateral displacement on the sleepers due to the load, is greater than that due to the resisting power of the spikes.

4. That if the load be more than 80 centners (—9,075 lbs.) per wheel the frictional resistances cause the rails to be supported at top and bottom against both canting and lateral displacement, and the support thus afforded is more effective than that due to the ordinary spiking.

5. That the forces tending to produce canting and lateral displacement due to the horizontal oscillations of the rolling stock, can only be resisted (at least in most cases) by the combined action of the spikes, the friction between the wheels and rails, and the friction between the rails and sleepers.

6. That if, therefore, the load upon one point of the structure be partially or entirely removed by the undue vertical oscillation of a vehicle, whilst, at the same time, a lateral oscillation of the vehicle takes place, the stability of the structure against the pressure due to this lateral oscillation depends solely upon the insufficient resting power of the spikes, and lateral distortion and displacement are the unavoidable consequences.

The last deduction is, as Baron von Weber justly considers, one of very great importance, and, in fact, the experimental researches upon which it is founded may be said to prove the cause which leads to the serpentine displacements of the rails, but too frequently met with on straight portions of a line of railway, particularly if the line is one of light construction, or is traversed by locomotives having considerable overhang at the leading and trailing ends. If such a portion of a line contains a sleeper badly bedded, which sinks uniformly throughout its entire length under the influence of a passing load, the vehicle passing over it will make but a heavy vertical oscillation, having no influence upon the lateral resting power of the structure. But if the sleeper sinks under one rail more deeply than under the other, the oscillation of the vehicle will be at once horizontal and vertical, and the load will be removed more or less, first from the trailing and then from the leading axle, thus causing the lateral pressure

due to the horizontal oscillations to be exerted through the tyres of the wheels with full power against the rails.

In such a case it is almost unavoidable that the point of the unloaded, or partially unloaded, structure should be displaced laterally; but this displacement having once occurred, the oscillations of the passing vehicle become so considerable, both in a horizontal and vertical direction, that the displacement of the rail is soon repeated, and only favorable circumstances, such as coincidence of the oscillations, can then produce an uniform motion of the vehicles. The displacements just referred to are considered by Baron von Weber to be the most dangerous, both for the stability of the structure and the passage of the trains, because their original causes can only be discovered with great difficulty, even when the permanent way is most carefully maintained.—Engineering.

[TO BE CONTINUED.]

Railroad Progress in the United States.

There is no central bureau in the United States having cognizance of the great railroad interests of the country. Only a few of the larger States demand any returns from the companies owning works, and these are neither uniform nor as full and definite as they might be. In this respect the United States stands alone, every other country in the world commanding complete historical and statistical details of works projected, in progress, or in operation at annual periods. It would be well for the companies and the public that this defect in our system (or want of system) should be remedied by the establishment of a central office, the duty of which should be the collection, arrangement and elaboration of all returns which a stringent law might call for.

The want of such a central point of information makes it a very difficult matter for a single individual (notwithstanding he may have accumulations of material covering the whole period of American railroad history) to bring together the details of the hundreds of railroads now existing, or even to state their length and cost.

Our annual attempts to do the latter have been more or less imperfect, and we have always told our readers that our summaries are only approximate. With the rapid increase of companies and enterprises the difficulty here complained of is increased; and so our tables become less and less reliable. We have done our best in the matter, however, and have come as near the truth as our means would allow of.

With these few remarks we introduce our annual statements: first, in the aggregates of States and Territories, and second, in detail or by separate works.

The following tabulation shows the distribution of mileage and cost of railroads in the several States and Territories:

States and Territories.	Length in Miles.—		Cost of road open. & equipment.
	Total	Open.	
Maine	972.01	810.31	\$24,291.90
New Hampshire	967.29	734.75	23,647.93
Vermont	658.41	618.41	32,488.594
Massachusetts	1,739.03	1,478.47	77,496.830
Rhode Island	135.80	125.80	4,505.946
Connecticut	977.87	723.75	34,976.834
	5,470.40	4,506.49	\$199,658.090
New York	5,453.74	3,892.38	\$234,049.545
New Jersey	1,241.30	1,091.80	74,935.196
Pennsylvania	6,312.96	5,056.06	206,739.037
Delaware & East Maryland	588.64	390.34	10,059.092
Maryland (West)	840.34	495.49	34,723.367
West Virginia	711.75	574.75	30,493.739
	15,078.73	11,300.63	\$600,589.976
Virginia	2,253.31	1,465.96	\$53,386.868
North Carolina	1,574.17	1,178.17	32,164.298
South Carolina	1,438.17	1,138.67	32,365.588
Georgia	2,313.70	1,932.70	44,322.919
Florida	607.30	440.90	11,781.919
	8,186.55	5,155.70	\$174,519.582
Alabama	2,190.80	1,396.00	\$46,578.606
Mississippi	1,117.80	977.80	33,308.839
Louisiana	944.50	478.50	10,532.789
Texas	4,071.50	665.50	22,050.000
Arkansas	1,084.00	286.00	8,795.000
Tennessee	2,016.08	1,490.08	51,588.745
Kentucky	1,375.41	907.37	33,040.699
	12,699.29	6,901.25	\$217,348.686
Ohio	4,800.97	3,638.09	\$192,538.214
Michigan	2,992.36	1,733.36	75,817.748
Indiana	4,865.90	3,277.60	125,957.186
Illinois	8,813.35	5,423.10	237,553.00
Wisconsin	3,142.30	1,475.30	50,882.881
	24,614.08	15,547.35	\$701,700.092
Missouri	4,573.42	2,140.13	\$106,663.464
Kansas	3,698.00	1,501.01	56,723.700
Colorado	1,368.00	368.00	17,400.000
Iowa	4,472.25	2,550.25	19,973.000
Nebraska	1,205.00	838.00	39,300.000
Wyoming Territory	4,920.00	492.00	46,700.000
Minnesota	2,654.00	972.00	34,723.000
Dakota Territory	700.00	.....	30,000.00
Montana and Idaho Territories	600.00	.....	.....
	19,662.67	8,611.38	\$413,785.164
California	3,293.60	996.60	\$70,624.582
Nevada	1,493.00	593.00	60,000.000
Utah Territory	404.00	364.00	49,000.000
Oregon	2,648.50	159.50	6,100.000
Washington Territory	420.00	.....	.....
	8,269.10	2,113.10	\$185,724.582
RECAPITULATION.			
N. E. States	5,470.40	4,506.09	\$199,658.090
Middle States	15,073.73	12,300.63	680,589.976
S. E. States	8,186.55	6,155.70	174,519.582
Gulf & S. W. States	12,699.29	9,601.35	217,348.686
Interior, E. of Mississippi	24,614.08	15,547.35	701,700.092
Interior, W. of Mississippi	19,662.67	8,611.38	413,785.164
Pacific States	8,259.10	2,113.10	185,724.582
Grand total	93,970.82	54,425.49	\$2,573,526.109

In the following table is shown the increased mileage and cost of railroads in the several sections during the year 1870:

	Miles of road projected.	Road opened.	Cost of road & equipment.
North East	594.04	231.73	\$10,363,292
Middle East	631.54	509.53	21,971,451
South East	436.69	318.22	10,519,325
Gulf & S. West	9,195.36	907.29	36,579,602
Interior, E. of Mississippi	3,409.71	1,449.05	53,401,538
Interior, W. of Mississippi	6,421.10	1,731.05	66,416,600
Pacific	2,087.00	428.00	25,874,582
Total increase	15,605.44	5,574.80	\$24,916,390

Though this increase is less than in 1869 by 1,013.57 miles, the result of the year, considering the draw-backs in consequence of the Franco-Prussian war, are eminently satisfactory, being an increase in mileage of 11.41 per cent. and in cost of 9.58 per cent. The average cost per mile of new road is \$40,345. This is by no means an extravagant estimate, and is probably as nearly correct as can be ascertained. The largest increase has been in the States of Illinois, Iowa, Missouri and Kansas, where railroad construction has been stimulated to the utmost by town and county subscriptions in the form of bonds. In Alabama and Georgia the companies building railroads have been encouraged by State subsidies. The same encouragement has been granted in North Carolina, but in that State with little advantage. And yet with all the rapid development, especially in the great interior States, we are somewhat disappointed in the results exhibited in our survey. So much work had been planned, commenced and carried on, that a larger increase of mileage might reasonably have been anticipated. The difficulties in Europe, however, breaking out suddenly in the middle of the year, closed foreign markets against American bonds, and made it impossible for companies in general to negotiate their paper or to carry forward intended or progressing works. Had peace been maintained we doubt not but that at least 10,000 miles of road would have been the compliment of the year 1870. The average cost of railroads in the United States, including the great overland lines which cost more than \$100,000 per mile or about 10 per cent. of the total cost of railroads is \$47,277 per mile. But few of the great trunk roads have cost less than \$80,000 to \$100,000 per mile; while in the South the cost of railroad building, notably in the Atlantic States, has not exceeded \$20,000 to \$25,000 per mile.

The progress of railroad construction in the United States since 1827, in which year the Granite Railroad, at Quincy, Mass., was inaugurated to the present time, is shown in the following table:

Year.	Miles open.	Yearly Increase.	Year.	Miles open.	Yearly Increase.
1827	.....	840	1840	6,359	668
1828	3	1850	7,475	1,125	1,114
1829	28	25,1851	8,589	1,114	2,458
1830	41	13,1859	11,027	2,470	2,470
1831	54	13,1853	13,497	2,470	2,470
1832	131	77,1854	15,627	2,175	2,175
1833	576	445,1855	17,398	1,736	1,736
1834	762	186	19,221	1,551	1,551
1835	918	156,1857	22,635	3,574	3,574
1836	1,102	184,1859	25,000	2,465	2,465
1837	1,431	329,1859	26,735	2,016	2,016
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General Railroad News.

OLD AND NEW ROADS.

Vermont Central.

According to the St. Albans *Messenger*, it is rumored that the Vermont Central has taken a twenty years' lease of the Rutland & Burlington, Vermont Valley, Vermont & Massachusetts, Plattsburgh & Montreal and Plattsburgh & Whitehall railroads, together with the property of the Burlington Steamboat Company—being all the property hitherto controlled by the Rutland & Burlington Company.

Rutland Railroad.

The annual meeting of the stockholders of this company was held at Rutland on the 26th of December, between thirty and forty thousand shares of the stock being represented, and by a unanimous vote of the stockholders the meeting was adjourned until January 26, 1871, at 10 a. m., at Rutland.

Lackawanna & Susquehanna.

It is reported that the Delaware & Hudson Canal Company is making surveys for an extension of the Lackawanna & Susquehanna Railroad, now under construction from Lanesboro northward to Nineveh, by continuing the road through to the Chenango Valley, and from there branching out to Utica, Auburn and Syracuse. Nineveh is 24 miles east of Binghamton, on the Albany & Susquehanna Railroad, which the Delaware & Hudson Company operates under a lease.

Great Western, of Canada.

According to the Toronto *Globe*, Wagner Drawing Room Cars will be run over a part of the line, not "simply for through passengers, but for local ones, so that those who wish to enjoy that luxury can have it for a comparatively small increase of fare, and that on a regularly graduated scale between the various stations on the line. It is to be first tried between Toronto and Buffalo, and then, if the encouragement is such as is confidently expected, extended to the whole line."

Port Huron & Lake Michigan.

The annual report of this company, dated December 1, 1870, says that 42 miles of iron are laid and 38 miles of road, from Port Huron westward, in operation. The decision of the Michigan Supreme Court on municipal aid interrupted the progress of the road somewhat, but other delay was due to the failure of contractors. The President reports:

"In addition to the shops and station buildings, mentioned in the last yearly report, the company have completed commodious depots at the Grand Trunk crossing, at Capac and Imlay City, and have laid over three thousand feet of side tracks, and have completed and put into use over one thousand feet of dock at Port Huron city. The road bed is well ditched, and the track properly ballasted and in fine condition for winter traffic. Sufficient additions have been made to the equipment to meet the increased demands of business, and nearly all repairs required are done at our own shops. The road was opened for traffic to Capac on the 8th day of June last and to Imlay City on the 28th day of July following."

The receipts from traffic were \$41,259.02; the amount charged to operating expenses, \$12,315.47. The Treasurer reports the receipts of the year at \$625,419.22, of which \$505,000 were from first mortgage bonds, \$4,400 from municipal bonds, and \$44,100 from stock subscriptions. The expenditure for construction was \$482,140.65; for equipment, \$84,492.86.

St. Joseph & Denver.

A correspondent in Marysville, Kansas, writes us that the track of this road was laid to that place, 122 miles from the Missouri River, on the 4th inst., and that regular trains were to commence running to Marysville on the 9th inst.

National Railway.

Of this company, which is organized to build a road from Philadelphia to New York, the Newark, N. J., *Advertiser* says: "The contract for the construction of the entire line of road has been awarded to Messrs. James Moore, Sidney Dillon & Co., the constructors of the Union Pacific Railroad, and the work is to be immediately commenced, and vigorously prosecuted. Nearly the entire right of way for four tracks, from Philadelphia to Newark, has been already secured, and measures are in progress for securing the remainder of the distance."

By the terms of the contract, the road is to be completed and put in running order within two years. It will be eighty-six miles in length, steel rail, a first-class road, and pass through no city or town at grade.

Alexandria & Fredericksburg.

The contractors have commenced the work of grading near Colchester, Va.

New Ohio Railroads.

The certificates of the Painesville & Ohio Valley Railroad, with \$1,500,000 capital, and of the west branch of the Painesville & Ohio Valley Railroad, with \$100,000 capital, were filed lately. The termini of the first-named road are Painsville and Youngstown, and of the last-named road, Chardon and Hudson.

The Dayton and Mineral Region Railroad Company has been organized to construct a road from Dayton through Montgomery, Greene, Clarke, Madison, Fayette, Franklin, Pickaway, Fairfield, Perry, Morgan, Muskingum, Noble, Guernsey, Monroe and Belmont counties, to the village of Belleair, in the last named county.

Chicago & Iowa.

A preliminary survey was begun last week of the extension of this road from Aurora to Joliet by way of Lockport. The roadbed is all ready for the ties on the section between Rochelle and Oregon, and the trestle-work is completed.

Madison & Portage.

It is expected that the Portage Railroad will commence running regular through trains to Madison depot the last of this week.

The Bergen Tunnel.

Chief Justice Beasley, of the New Jersey Supreme Court, gave a decision in the suits of the Erie and the Delaware, Lackawanna & Western railroads, involving the right of way through the Bergen Tunnel. He refuses to appoint a receiver for the tunnel, and holds that the Erie Company has the exclusive right to make regulations governing traffic through the tunnel; and, also, that the Erie time-table must have precedence.

St. Louis & Southeastern.

This company is constructing a Howe truss bridge 1,100 feet long over the Wabash River, east of Carmi, for the use of its Evansville Branch. Griffith & Van Wagenau are the contractors. It is to be ready for the passage of trains by the 1st of August next.

North Missouri.

The Secretary of this company gives the following list of lines operated by it on the 1st inst.:

	Miles.
From St Louis to Kansas City	272
From Moberly to Ottumwa	130
Columbia Branch—Centralia to Columbia	22
St. Louis & St. Joseph Railroad	72
Bricksville & Chillicothe Railroad	34
Total	550

One hundred and twenty-six miles of which has been constructed during the past year.

It is constructing the St. Louis, Council Bluffs & Omaha Railroad from Chillicothe to Council Bluffs, 174 miles, and expects to complete it this year.

Western Maryland.

This railroad was formally opened to Mechanicsburg, a distance of 61 miles from Baltimore, on the 29th of December.

Elizabethtown, Lexington & Big Sandy.

Messrs. Cutler, Jones & Co., of Cincinnati, have taken the contract for the building of the Eastern Division of the Elizabethtown, Lexington & Big Sandy Railroad, commencing at Lexington and running to the Big Sandy River. Four thousand hands are to set to work about the 1st of next March, and the road is to be completed in two years. This line will connect the Chesapeake & Ohio with the Elizabethtown & Paducah Road. In connection with the latter it will form an east and west line across Kentucky.

Rockford, Rock Island & St. Louis.

The Rock Island *Union* of late date says of this road: "We are gratified to hear of the general prosperity of this road. We have watched the rapid progress of its construction during the past summer, with a great deal of interest, and felt confident that, when completed, it would prove one of the most important lines in the State of Illinois. As much importance as we have attached to this route, we must confess that our most sanguine expectations have been outstripped by the showing the road makes in the way of passenger travel and transportation of freights. It will be remembered that the through line from St. Louis to Sterling has been completed but little over two months. The greater share of this line has been built within the last twelve months, (the whole distance being 291 miles) and it seems hardly credible that it should be doing such an immense traffic in so short a time. Indeed, the rapidity with which the road has been built has scarcely given the public an opportunity to become acquainted with its alignment."

Pacific, of Missouri.

The Missouri *Democrat* gives the following account of the improvements and additions on this line during 1870: "Over fifty miles of entirely new iron has been laid in the track, and over eight miles of side track have been constructed, thereby assisting materially in the move-

ment of trains. One hundred new freight cars, thirty locomotives, and four new passenger coaches have been added. Others are under construction, to be ready by the opening of the spring trade."

St. Louis & Iron Mountain.

This company's traffic during the year 1870 is reported, as follows, in the Missouri *Democrat*:

"It has transported during the year from the Iron Mountain, Pilot Knob, and from the hematite ore beds of Madison county over 543,000,000 pounds of iron ore; from the Iron Mountain, Pilot Knob and the Irondale furnaces, 19,360,000 pounds of charcoal pig iron; from the various lead furnaces, 9,675,000 pounds of lead, and from the mills adjacent to its line, 29,300,000 feet of lumber. The through traffic to points in the Southern States has increased faster than the company have been able to provide cars for it. Merchandise is shipped through, without change of cars, to Atlanta in three days, Augusta in four days, Mobile, three and one-half days, New Orleans in four days, and to the Atlantic seaboard in six days. Large shipments of coffee have come through from Mobile to St. Louis in three and one-half days. Although the road has been unable to move all the freight offered it, yet its stable tariffs have acted at all times as a regulator of the fluctuating and, at times, excessive rates by river."

San Francisco & North Pacific.

The road was completed to Santa Rosa, in Sonoma county, about 50 miles northwest of Vallejo, on the 30th ult.

Cleveland, Columbus, Cincinnati & Indianapolis.

A special meeting of the stockholders will be held at Cleveland on the 25th inst., to vote upon a proposition to aid in the connection of, and leasing a line of railroad between Springfield and Cincinnati, Ohio, and upon a contract with the Cincinnati, Sandusky & Cleveland Railroad Company, for running and business arrangements.

Ottawa, Oswego & Fox River Valley.

The last rail was laid last Saturday, the bridge over Fox River, at Sheridan, being then completed, and a train ran through from Aurora to Streator. The Chicago, Burlington & Quincy Company is putting up a telegraph line along the road.

Milwaukee & Northern.

On the 3d inst. the completion of twenty miles of the road, from Milwaukee to Cedarbury, was celebrated by a grand excursion of the officers of the company and many prominent citizens of Milwaukee and vicinity. The company was organized last April.

Des Moines Valley.

The road was opened to Fort Dodge, and many officers of the company passed over and examined the new line on the 2d inst.

Lexington & St. Louis.

The negotiations of Mr. Wm. Morrison, President of the company, with the Pacific & Missouri Company, for the completion of the Lexington Road—referred to in these columns last week—have been successful. The Pacific Company have agreed to assume the payment of a debt of \$63,000, held against the Lexington company by the National Loan Bank, of St. Louis, and to complete the road. The St. Louis road is to furnish \$48,813, one-half when the track is laid to Concordia and the other half on the completion of the road to Lexington. The road bed is already constructed and the culverts built, and the Pacific Company will proceed at once to purchase the iron and lay it down. It will be necessary for \$100,000 to be raised along the line to pay off the debts of the road, and if this is promptly done, it is thought the work will be finished by the 1st of July next.

Leavenworth, Atchison & Northwestern.

The company for some time past has been at variance with the city of Leavenworth in the interpretation of the terms of the contract by which right of way for a double track through the city was granted to the company. The position of the city, as expressed by the Leavenworth *Times*, is:

"The right of way through our city was granted to the Leavenworth, Atchison & Northwestern Railroad Company. The conditions of the grant were that the company should grade, pave and rip-rap the levee, and within a specified time erect a first-class union freight and passenger depot adequate to the accommodation of all railroads desiring, on reasonable terms, its use."

"The company failed to perform the conditions within the time named, which was twice extended beyond the original limits. The company has also made known its intentions not to perform those conditions."

"Under these circumstances the city has resumed the right of way which has been forfeited by the failure of the railroad company."

"There is no intention or desire on the part of our city to prevent the passage of trains, to cause the

breaking of bulk, or to injure in any way commerce with Northern Kansas. On the contrary, the city stands ready to grant on reasonable terms the right of way to any railroad company that will undertake to make good connections with Northern and Southern Kansas."

We have not learned on what ground the company refuse compliance with the demands of the city; their position will probably soon be defined, however, as the City Marshal, on the 5th inst., by instruction of the Mayor and in compliance with an ordinance, proceeded to the track and removed two of the rails, preventing, up to the present time, the passage of trains through the city.

The company have since presented two petitions before Judge Dillon, at Davenport, Iowa. The petition contains two prayers, first, that the city be restrained from further interference with the track, and second, that the company be permitted to repair the same. Unless the company should gain its second request any decision in its favor on the first will be valueless to it.

Northern Pacific.

The contract for building 85 miles of the road, from Columbia River to Puget's Sound, has been let to Messrs. F. E. Canda & Co., of Chicago.

Aurora to Joliet.

A party of surveyors is surveying a route for a road between these two cities by way of Plainfield and Lockport.

Ionia, & Lansing, and Detroit, Howell, & Lansing.

The Directors of the Ionia & Lansing Railroad (Michigan), held a meeting in Lansing, on Monday last, to consider articles for the consolidation of that road with the Detroit, Howell & Lansing Railroad. The articles were adopted by a unanimous vote. The stockholders of the Ionia & Lansing Railroad met in Portland on the 10th of the present month to consider and ratify the act of their directors, and the stockholders of the Detroit, Howell & Lansing Railroad met in Detroit, on the same day, for the same purpose. If the stockholders of both roads accept the terms of consolidation, a meeting of stockholders will be held in Detroit, on February 25, to elect directors of the new company.

Milwaukee & St. Paul.

The company has issued a corrected time table under date of January 9, for the benefit of the public. It is a sheet of eight pages, 11 inches by 9, giving on the first page, besides the title, the names of the eating houses on the company's lines, and a list of the lines operated by the company and the length of each. There are eleven separate lines in this list with an aggregate length of 1,018 miles. A detailed time-table of each division is given, and only a small amount of advertising, which is chiefly devoted to urging passengers from the East and South for any points on its lines to make Milwaukee its starting point, as connections are made directly with trains from that point, and there berths can be secured in its sleeping cars.

The time-tables of the Milwaukee & Northern and the West Wisconsin roads now operated by the Milwaukee & St. Paul, are also given.

Atchison & Nebraska.

This railroad is now open for business from Atchison northward to Iowa Point, about 25 miles, and will very soon be completed to White Cloud, five miles further. The stations are Atchison, Donniphon, Brenner, Troy, Highland, Iowa Point and White Cloud. It has lately received new rolling stock sufficient for its present needs.

MECHANICS AND ENGINEERING.

The Winona Bridge.

The temporary winter railroad bridge over the Mississippi at Winona was completed, as expected, before the 1st of January. The entire work was done in less than four days. Its length is eleven hundred feet and cost about \$5,000. The Winona Republican describes the process of construction as follows:

"First they had to clear the ice and drive small piles down to hold the pile driver, the ice not being strong enough. Then the piles have to be distributed ready for use as fast as required, which keeps a number of men and teams busy. Carpenters follow up the pile driver, sawing off the piles to the desired height and putting on the timbers and stringers. Then come the tracklayers with the ties and iron, following so closely that by the time the last pile is driven the last rail will be ready in a few hours to rest upon it."

"Leaving the island, the bridge starts on almost a direct line from the railroad bridge from the Wisconsin shore to the island and makes a graceful and easy curve, coming in on this side between the depot and elevator. It will be a great convenience for the winter, and will be taken up when the ice breaks up in the spring."

"The deepest water found in crossing the river was eighteen feet. The piles are from twenty-five to thirty feet in length and are driven into the ground from eight to ten feet. The water freezing up close to them at the surface, forms a solid and strong brace."

The Advantage of Small Cars.

Mr. Robert Fairlie, in a letter to *The Engineer* of the 23d ult., says that the "great element in the gauge question does not depend so much on the reduction which could be made by any means whatever on the weight of the present rolling stock, retaining the same capacity, as the reduction in capacity itself." He believes that the disproportion of load to vehicle is chiefly due, not to the lightness of the load, but to the size and consequent weight of the vehicle, and that if the cars were one-half or one-third as large, they would be much more frequently fully loaded. It follows, of course, that if the size of the cars be reduced on the ordinary gauge, which we believe to be entirely practicable, this advantage could be secured on that as well as on a narrower gauge.

Charcoal Iron for Rolling Stock.

A correspondent of the London *Engineer* urges the importance of using charcoal iron crank-pins, axles, couplings and draw-bars, as much stronger, more fibrous, more ductile, and "infinitely less liable to become crystalline (cold-short) by the vibratory or tremulous motion to which these parts are exposed in traveling." He shows that the difference in price is but a half-penny a pound, and illustrates the strength of the charcoal iron by an instance when, of twenty-nine vessels moored in a roadstead during a great gale, all broke from their moorings except the two which had cables of charcoal iron.

Omaha Bridge.

Within the past two weeks four pneumatic tubes have been sunk to rock bottom, a depth of 73 feet. The engineers are confident that the bridge will be ready for crossing by the 1st of September next. The passenger trains of the Union Pacific Railroad are now crossing the river on a temporary bridge.

TRAFFIC AND EARNINGS.

The following is the report of the St. Louis, Vandalia, Terre Haute & Indianapolis Railroad of the tonnage for the past year, running only ninety-eight miles (to Effingham), up to June 14th, at which time the entire line was completed, is as follows:

Amount forwarded.....	102,815,382 lbs.
Amount received.....	178,175,945 "

Total..... 281,991,327 lbs.

The North Missouri Railroad reports its receipts as follows:

Freight receipts from Dec. 1st, 1868, to Dec. 1st, 1869.....	\$1,065,883 87
Freight receipts from Dec. 1st, 1869, to Dec. 1st, 1870.....	1,663,957 96

Excess..... \$595,094 09

Passenger receipts from Dec. 1st, 1868, to Dec. 1st, 1869.....	\$864,579 28
Passenger receipts from Dec. 1st, 1869, to Dec. 1st, 1870.....	1,127,623 21

Excess..... \$363,042 44

An increase of over fifty per cent. on freight and over 30 per cent. on passenger business.

The Grand Trunk Railway received for transportation during the week ending December 10, 1870, £31,900, and during the corresponding week in 1869, £31,200.

The traffic receipts of the Great Western Railway of Canada for the week ending December 16 amounted to £18,668, against £16,632 in the corresponding week of last year, showing an increase of £2,036.

LOCOMOTIVE STATISTICS.

Hannibal & St. Joseph.

The annual report of the company for the year ending August 31, 1870, shows that there were forty-six engines employed on the road during the year. The number of miles run was as follows:

Passenger engines.....	535,487
Freight engines.....	1,226,139
Construction engines.....	191,271
Switching engines.....	165,493

Total..... 2,108,367

The expense of running these engines was as follows:

Waste, lbs.....	68,199
Tallow, lbs.....	7,423
Oil, pints.....	110,008
Coal, tons.....	50,522 1/4
Wood, cords.....	2,861 1/4

The value of which is as follows:

Waste, oil and tallow.....	\$18,182 64
Coal.....	143,981 07
Wood.....	11,445 00

Total..... \$178,558 71

The additional expense footed up as follows:

Wages of engineers, firemen and wipers.....	\$160,173 45
Labor and material for repairs.....	912,866 12

Total..... \$1,073,039 57

Toledo, Peoria & Warsaw.

The following is the report of the general average of performance of locomotives on the Toledo, Peoria &

Warsaw Railway for the month of November, 1870, as made by A. H. de Clercq, Master Mechanic:

Passenger trains.....	23,901
Freight ".....	36,553
Miscellaneous ".....	23,235

Total number of miles run..... 88,739

The cost per mile run was for:

Engineers, firemen and wipers.....	6.86 cts.
Oil, waste, tallow and rags.....	1.34 "
Repairs.....	5.86 "
Fuel.....	6.55 "

Total cost per mile run..... 24.79 cts.

Average number of miles run to

Pint of oil.....	15.39
Ton of coal.....	42.38

The company have 45 locomotives, of which but 34 made mileage during the month; one is rebuilding, two are in shop for general overhauling, two are laid up in bad order, one laid up in good order, and one laid up for want of service. Coal is charged at \$2.75 per ton.

PERSONAL.

The officers and employees of the Leavenworth, Lawrence & Galveston Railroad Company gathered round their General Superintendent, Mr. M. R. Baldwin, last week and presented him with a silver service valued at \$315, and to Mrs. Baldwin a pair of bracelets worth \$110.

To Mr. E. Sweet, Jr., now Chief Engineer and General Superintendent of the Rockford, Rock Island & St. Louis Railroad, have been ascribed many accurate engineering calculations, and estimates which show his familiarity with the work. It is said that on the northern division of the line, where the bridging was very expensive, his estimates were within sixteen hundred feet of the actual requirement.

In the month of September he passed over the line to Rock Island where he was to receive the forwarded estimates of a division engineer, on twelve miles of cuts and embankments. Over that twelve miles he walked, making notes on the work, without the use of an instrument, and by a calculation he made from those notes, after an examination of the division engineer's estimate, he telegraphed to his division engineer that there must be a mistake of 50,000 yards. A revision of the report by the engineer proved Mr. Sweet's calculation correct within 2,000 yards.

Of the nine directors of the Flint & Pere Marquette Railroad Company, four, besides the President and Vice-President, are officers: one is Secretary and Treasurer; a second, Superintendent; a third, General Ticket Agent, and a fourth, Land Commissioner.

Capt. Henry Pratt, who has long had a confidential position in the general office of the Lake Shore & Michigan Southern Railway, in this city, first with Mr. M. L. Sykes, Jr., when he was President, then with Mr. E. B. Phillips, and since with Mr. Devereux, has resigned to take a position with Mr. Phillips, in the construction of the new Wisconsin roads.

Col. W. H. Greenwood, who has been for some time Chief Engineer of the Kansas Pacific Railway, has resigned. Hereafter, it is understood, E. C. Smeed, late Resident Engineer, will have charge of the maintenance of way, and the General Superintendent, Mr. A. Anderson, will have general supervision of engineering operations.

ELECTIONS AND APPOINTMENTS.

The following is the result of the late election of the Port Huron & Lake Michigan Railroad Company: Directors—Edgar White, Port Huron; W. L. Bancroft, Port Huron; James Turrill, Lapeer; Artemus Thayer, Flint; Isaac Gale, Bennington, Mich.; W. F. Allen, Albany, N. Y.; W. Drake, New York. President, Edgar White; Secretary and Treasurer, W. L. Bancroft.

—Ebenezer Westcott has been elected President, and R. R. Bateman, Secretary and Treasurer of the Bridgeport & Port Norris (N. J.) Railroad Company.

—H. J. Kimball, of Atlanta, Ga., has been elected President of the Brunswick & Albany Railroad Company.

—W. S. Wilson, of Philadelphia, is appointed Purchasing Agent of the Philadelphia & Reading Railroad.

—At a meeting of stockholders of the Dubuque & Minnesota Railroad Company, on the 4th inst., the old Board of Directors was re-elected, consisting of Messrs. J. K. Graves, J. A. Rhomberg, W. Andrew, Sol. Turck, John D. Bush, J. H. Merrill, and S. T. Woodward. The directors re-elected J. K. Graves, President; J. A. Rhomberg, Vice-President; C. H. Booth, Treasurer, and Peter Kiene, Jr., Secretary. J. A. Rhomberg was elected Superintendent of Construction. The proposition to change the name to "The Chicago, Minnesota & Dubuque Railroad Company" prevailed.

—At a stockholders' meeting of the Kansas & Missouri Bridge Company, held at their office, January 4, 1871, the following-named gentlemen were elected directors for the ensuing year, the number of the board, by resolution of the stockholders, being reduced to thirteen: John F. Tracy, of New York, President Chicago, Rock Island & Pacific Railroad Company; F. H. Winston, President Chicago & Southwestern Railroad Company; Hon. J. W. Burns, of Weston, Vice-President Chicago & Southwestern Railroad Company; L. B. Boomer, of Chicago; G. R. Hines, A. M. Clark, H. Edgerton, John Harmon, E. Hansley, W. E. Chamberlin, H. D. Rush, D. W. Eaves, J. W. Richards.

At a meeting of the directors, Geo. R. Hines was elected President; E. Hensley, Vice-President; A. M. Clark, Treasurer; Geo. H. Hide, Secretary.

—Mr. W. H. Pettibone, late Assistant Superintendent of the Rockford, Rock Island & St. Louis Railroad, whose resignation we chronicled two weeks ago, has been appointed General Superintendent of the Davenport & St. Paul Railroad, lately opened for business between Davenport and Maquoketa. His headquarters are at Davenport.

—At a meeting of the stockholders of the Davenport & St. Paul Railroad Company held in Davenport on the 5th inst., the following directors were chosen: John L. Davies, Michael Donnahue, Thomas F. Butterfield, George Rule, Geo. W. Lathrop, Robert Krause, Jno. E. Goodenow, W. H. Finley, John H. Berryhill, B. Burch, J. A. Bronson. Mr. Burch resigning, H. S. Bronson was elected in his stead. At a subsequent meeting of the Board of Directors, Hiram Price was re-elected President, and M. A. Barnes Vice-President. Some three thousand votes were cast in this election. The capital stock was raised from three to nine millions.

—A meeting of the stockholders of the Chicago & Rock River Railroad was held at Sterling, Ill., a few days ago, at which the following Directors were elected: Wm. Hanley, Lockport; J. R. Ashley, Plainfield; A. Kenyon, Amboy; A. P. Smith, Rock Falls; H. E. Badger, Amboy; A. Wheeler, Rock Falls; M. B. Castle, Sandwich; O. P. Johnson, Melugin's Grove; R. M. Pritchard, Shabona; Simon Elliott, Dover; S. W. Hopkins, New York, (contractor). Judge Kenyon was made President; James M. Gale, Treasurer; and A. P. Smith, Vice-President. In addition to the foregoing, the Governor is to appoint four more directors.

—W. C. Thompson succeeds Beverly R. Keim as Assistant General Passenger Agent of the Union Pacific. Mr. Thompson was, we believe, formerly in the service of the Boston & Albany Railroad, and more lately General Freight and Ticket Agent of the Alabama & Chattanooga Railroad.

—The directors of the Decatur & State Line Railroad Company, met at Decatur, on the 4th inst., and elected the following officers: President, H. H. Porter, Chicago; Vice-President, E. V. Smith, Decatur; Secretary, Geo. C. Campbell, Chicago; Assistant Secretary, W. H. Anderson, Farmer City; Treasurer, F. H. Winston, Chicago; Attorneys, Weldon & McNulta, Bloomington. The contract to build and complete the road was let to Snell, Taylor & Co., the work to be done within two years.

MISCELLANEOUS.

—A letter from Vincennes, Indiana, says: "Considerable excitement is now manifest in this city, and along the line of the Wabash River, at the prospect of having our river so improved that we shall have the continual use of it for slack-water navigation. This river is navigable only about six months in the year, and hence there is but little inducement for any one to go into the steamboat business on the Wabash. We have an old, reliable steamer at our wharf, known as the Advance; but she has been waiting to *advance* for the past six months, with but little prospect of *going up* soon, unless we should have heavy rains. Petitions are in circulation asking Congress for an appropriation, as the government officer appointed to make an examination of the river will report the project to be a feasible one."

—The County Court of Alexander county, Ill., has made an order declaring that a contract by which that county agreed to issue its bonds for \$100,000, accept an equal amount in the stock of the Cairo & Vincennes Company, and sell back the stock for \$5,000, was not warranted by law, and, moreover, that the whole contract is void by reason of the failure of the company to begin and prosecute the work as it agreed.

—The convention of railroad managers, which met last week at Augusta, Georgia, and adjourned on the 7th inst., agreed to a new schedule, which will make the time between New York and New Orleans 77 instead of

96 hours, the present time, making a saving of 19 hours for through passengers, to take effect on the 22d inst. The Richmond, Fredericksburg & Potomac, and the Bay route, *via* Norfolk, are opposed to any change of schedule; but a committee has been appointed by the convention, to confer with the President of the Fredericksburg and Bay routes, and ask them to make the necessary arrangements, so that passengers will not be subjected to the inconvenience of delay, either in Washington or Baltimore. If they do not consent, a thorough and uninterrupted travel will be established with the Chesapeake & Ohio Railroad, by which the delay at the national capital will be avoided. Since the interruption of travel by the Fredericksburg route, on account of ice in the Potomac, the Chesapeake & Ohio Railroad has carried the mails, express, and all through passengers.

—The contract for building a bridge across the Platte River, opposite Fremont, Neb., has been let, by the County Commissioners, for \$50,000, to R. W. Smith & Co., of Toledo, Ohio.

REGISTER OF EARNINGS.

FOR THE YEAR 1870.

Central Pacific (742 to 890 miles), 1870.	\$7,983,513 00
" (350 to 690 miles), 1869.	5,670,882 00
Increase (40% per cent.)	\$2,312,631 00
North Missouri (404 miles), 1870.	\$2,883,399 00
" (404 miles), 1869.	2,024,860 00
Increase (40 per cent.)	\$408,539 00
Chicago & Alton (431 to 465 miles), 1870.	\$4,881,739 80
" (431 miles), 1869.	4,681,562 81
Increase (3.2 per cent.)	\$150,176 99
Michigan Central (284 miles), 1870.	\$4,755,987 00
" (284 miles), 1869.	4,749,163 00
Increase	\$6,894 00

FOR THE MONTH OF DECEMBER.

Michigan Central (284 miles), 1870.	\$287,827 61
" (284 miles), 1869.	374,542 90

Increase (3½ per cent.)	\$13,284 71
Chicago & Alton (465 miles), 1870.	\$386,598 84
" (431 miles), 1869.	349,860 95

Increase (13½ per cent.)	\$45,747 91
Marietta & Cincinnati (251 miles), 1870.	\$141,376 00
" (251 miles), 1869.	109,629 00

Increase (20 per cent.)	\$31,747 00
North Missouri (404 miles), 1870.	\$255,726 00
" (404 miles), 1869.	203,595 00

Increase (25½ per cent.)	\$34,131 00
Central Pacific (890 miles) 1870.	\$612,806 00
" (690 miles) 1869.	467,659 00

Increase (31 per cent.)	\$145,146 00
FOR THE FIRST WEEK IN JANUARY.	

Chicago & Alton (465 miles), 1871.	\$79,787 55
" (431 miles), 1870.	63,517 50

Increase (26 per cent.)	\$16,470 05
Michigan Central (284 miles), 1871.	\$80,511 50

" (284 miles), 1870.	67,574 07
Increase (19 per cent.)	\$12,937 43

The receipts from all sources for the first week were \$36,930 89.

Arkansas Railroads.

We extract the following passage concerning railroads from Governor Clayton's recent message to the Legislature:

In my first message to the General Assembly, delivered July 3d, 1868, I took occasion to recommend the passage of a bill authorizing the loan of the bonds of railroads. The Legislature acted promptly in the matter, and passed a bill which at the general election following, was submitted to the people and approved by a very large majority. To the passage of this and its auxiliary, the funding bill, may be attributed the impetus that has been given to several of our most important railroad enterprises. All of the roads to which aid was awarded, but one, are in rapid process of construction. The completion of these railways will be of incalculable benefit to the State at large, and will doubtless eventually result in making this, our capital city, one of the great railroad centers of the United States.

The following is a statement of the companies to which aid has been awarded, and the amount of aid granted to each:

The Cairo & Fulton Railroad Company to the extent of 300 miles of its line, at the rate of \$10,000 per mile, \$30,000.

The Memphis & Little Rock Railroad Company to the extent of 120 miles of its line, at the rate of \$10,000 per mile, \$1,200,000.

The Little Rock & Helena Railroad Company to the extent of 30 miles of its line, at the rate of \$15,000 per mile, \$450,000.

The Mississippi, Ouachita & Red River Railroad Company to the extent of 130 miles of its line, at the rate of \$10,000 per mile, \$1,300,000.

The Little Rock, Pine Bluff & New Orleans Railroad Company to the extent of 120 miles of its line, at the rate of \$15,000 per mile, \$1,800,000.

The Little Rock & Fort Smith Railroad Company, to the extent of 150 miles, at the rate of \$10,000 per mile, \$1,500,000.

The following is a statement of the companies to which bonds have been loaned, and the amount to each:

To the Little Rock & Fort Smith Railroad Company, bonds to the amount of \$800,000; to the Memphis & Little Rock Railroad Company, bonds to the amount of \$1,050,000; to the Little Rock, Pine Bluff & New

Orleans Railroad Company, bonds to the amount of \$600,000; to the Mississippi, Ouachita & Red River Railroad Company, bonds to the amount of \$300,000.

It gives me great pleasure to be able to present to you the following encouraging reports of progress made in the construction of the various railroads, furnished me by their respective Presidents.

CAIRO & FULTON.

It is represented that 20 miles of this road are furnished. I have applied to the President for a report, but up to this time have not received one.

LITTLE ROCK & FORT SMITH

It is now open to Lewisburg, fifty miles, and has been running regular trains to that point since November 21. Fifty miles more are already graded, and the ties are down ready for travel in February, and the entire road from Little Rock to Fort Smith will be completed on or before 1st of January, 1872. The track, locomotive, passenger and freight cars are first-class in every respect. Close connections are now made from Lewisburg to all points from there to Fort Smith and Van Buren and points beyond.

MEMPHIS & LITTLE ROCK.

The following is a statement of the present condition of the work on this road, furnished to Hon. R. C. Brinkley by the Chief Engineer, J. L. Meigs, Esq., December 13, 1870:

" Miles of track laid, 115 77-100; miles of track to be laid, 15 35-100: of the road-bed upon which the track is yet to be laid, 3 14-100 are ready for the rails; 1 41-100 miles are very nearly completed, and 3 76-100 miles are half done; the remainder, 6 84-100 miles, have strong forces actively at work on them. White River bridge masonry will be ready for the draw-bridge by January 1st, and the river piers are believed to be so far advanced as not to be in danger of an overflow this winter. The iron draw-bridge is complete, together with the iron work of the fixed spans. The wooden work and brace piers are sawed and ready for transportation. More than one hundred men are at work on the road, and the arrangement for the completion of the Cache River Valley earthwork and pile work are such that there is no ground to apprehend delay from high water. We may now confidently expect the completion of the road early in 1871."

LITTLE ROCK, PINE BLUFF & NEW ORLEANS.

The following report of J. E. Sickles, Chief Engineer, is submitted:

Fifty-five miles of the roadbed of the Little Rock, Pine Bluff & New Orleans Railroad have been graded, bridged and furnished with cross-ties, and sixteen miles of track have been laid. The work was commenced in January last, and has been steadily prosecuted westward from the nearest available landing on the Mississippi River during the summer months, and notwithstanding the sickness of the season, which was unprecedented, a large force of laborers has been kept employed. The number of laborers now at work will reach at least six hundred, and, at the present rate of progress, I think it entirely safe to promise that the road will be open to Pine Bluff before the first of March, 1871. The preliminary surveys between Pine Bluff and Little Rock have been completed and the corps of engineers are now engaged surveying the route from Monticello southward through Hamburg to the State line.

MISSISSIPPI, OUACHITA & RED RIVER.

The following report of this road is from Hon. Thomas Bowen, its President:

" I have to report that between forty and fifty miles of the Mississippi, Ouachita & Red River Railroad, commencing at the Mississippi River, have been graded, bridged, and tied, and that between sixteen and twenty miles of the track (being about one-eighth of the line) has been laid, and the road for that distance put into operation. We have two locomotives and a number of box and flat cars. The work is progressing in a manner highly satisfactory to the management, and the surveys and engineering is progressing from Camden west. The people along the line of the road have been extremely liberal in voting corporate subscriptions, and I feel entirely safe in saying that the road will be completed to Camden by the last of June next, unless prevented by causes unseen at this time. The company had contracted for seventy-five miles of iron, the delivery of a large portion of which has been delayed, otherwise we could have been running the road to Sline River, fifty miles from the eastern terminus, some time since."

The Hastings Bridge.

Work on this bridge of the St. Paul & Chicago Railroad, over the Mississippi River, is advancing. The pile driver is now on the ice driving piles for pier No. 4.

The piles are to be cut off from six to eight feet below the surface of the water, as level as possible, by a circular saw on a vertical shaft twenty feet in length, driven by steam power. A platform or crib of timber, twenty inches in depth, with sides made of plank caulked so as to be water tight, will then be sunk upon this pile foundation by commencing the masonry of the pier, in its proper form on this platform and continuing it until the superstructure is grounded on the piles, and in its right position.

The Hannibal Temporary Bridge.

The work on this structure is progressing rapidly, and it will soon be ready for the transfer of cars. The cost of the bridge will not exceed \$3,000, and it is estimated, if the weather continues so that it can be operated forty days, the stockholders will realize three times that amount from their investment.



PUBLISHED EVERY SATURDAY.

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Editorial Announcements.

Correspondence.—We cordially invite the co-operation of the Railroad Public in affording us the material for a thorough and worthy Railroad paper. Railroad news, annual reports, notices of appointments, resignations, etc., and information concerning improvements will be gratefully received. We make it our business to inform the public concerning the progress of new lines, and are always glad to receive news of them.

Inventions.—Those who wish to make their inventions known to railroad men can have them fully described in the RAILROAD GAZETTE, if not previously published, FREE OF CHARGE. They are invited to send us drawings or models and specifications. When engravings are necessary the inventor is expected to furnish his own engravings or to pay for them.

Articles.—We desire articles relating to railroads, and, if acceptable, will pay liberally for them. Articles concerning railroad management, engineering, rolling stock and machinery, by men practically acquainted with these subjects, are especially desired.

Engineering and Mechanics.—Mr. M. N. Forney, Mechanical Engineer, whose office is at Room 7, No. 72 Broadway, New York, has been engaged as Associate Editor of this journal in charge of these departments. He is also authorized to act as our agent.

Removal.—About the tenth of January next the office of the Railroad Gazette will be removed to Nos. 110 and 112 Madison Street.

Our Prospectus and Business Notices will be found on the last page.

RAILROAD SERVICE REFORM.

At the present time, when so much is said about civil service reform, perhaps a little reflection on the subject, which we have taken for our text, may not be amiss. It is a topic on which so many stupid things can so easily be written that we confess it is with some trepidation that we undertake to write about it. It would be perfectly true to say that when men are paid for their services they should take some interest in their employers' affairs, that employees should be intelligent and not stupid, watchful and not careless, honest and not get their ideas of "mine and thine" mixed. Alas for human nature and the good of railroad companies! many employees are constantly doing what we have said they should not, and more things of a similar character. We do not, of course, mean to say that all the men employed on railroads are unfaithful, ignorant, indolent, or dishonest. On the contrary, the surprise is, considering all the attending circumstances, that so much care, knowledge, energy and integrity can be procured for the wages usually paid. A great cause for regret is, that, under the existing system of things, men get no reward for their honesty, and that diligence in their business has so little influence on the pay roll. Intelligence and knowledge somehow do not usually seem to increase the value of railroad employees in the esteem of their employers, and the man who is stupid or wasteful is paid as much as he who saves by his care more than the amount of his own salary. The natural effect of this is to make men careless. They do not see that economy does them any good, and it requires strong moral character to keep up a sustained con-

scientious performance of duty, without any apparent reward.

Of course many men, also, fall into great error concluding that diligence and general faithfulness is not recognized at all. They do not know of the recognition, and therefore infer that there is none. Loss of faith in the old-fashioned, economical virtues is one of the many evils which result from the employment of large numbers of men by the agents of corporations. This skepticism, like all unbelief in virtue, is a mistake, but it is a natural result of the present method of administration. In the long run, of course, the virtues will be in favor of the most humble mechanic and laborer. It may require some patience and much waiting, but in the end industry, energy and intelligence will win. It is, however, desirable to bring the laborer and the reward for his virtues nearer together, and make the one more dependent on the other.

The subject is certainly of sufficient importance to justify some reflection and experiment on it. At the present time coal, and oil, and waste, and a hundred other things are used on railroads often without thought or care. Through the whole length and breadth of the country, wasteful volumes of smoke and cinders are pouring from the smoke stacks of locomotives, and oil cans literally drop fatness, while those who handle them complain of their poverty. What we desire to suggest—or rather inquire—is, whether some practicable plan could not be adopted by which the employees could receive a share of what they could save by their knowledge, care or skill. If a portion of that which is now wasted could be turned into the pockets of those who save it, the destruction could be arrested, much to the advantage of the men and their employers.

What is wasted is just that much wealth destroyed, for which no one derives any benefit whatever. Not only the railroad companies, but indirectly the whole community, are the losers thereby.

A locomotive consumes from $2\frac{1}{2}$ to 10 tons of coal per day. If those engaged in running it feel no interest in using the fuel and other material to advantage, or do not understand their business, there will be much useless waste. It is a very low estimate to say that it is easy to make a difference of from 10 to 20 per cent. in the amount of coal burned. Suppose, for example, a locomotive burns three tons of coal per day. In, say, 300 days in the year, this would amount to 900 tons. At \$5 per ton this would amount to \$4,500. If the fireman and runner could save 10 per cent. of this, it would amount to \$450 per year. If they received one half, their portion would be \$225, or, say, \$100 for the fireman and \$125 to the runner, at the same time the railroad would be \$225 richer. The additional pay would enable each of the men to live more comfortably, or to educate their children better, which, at the same time, by the constant practice of their skill and care, they would each year become more valuable men to the company.

We have taken the case of the fireman and locomotive runner as an illustration merely. The same thing is true of all departments of railroad operation. The loss from waste and "leakage" of all kinds is what so often prevent this kind of property from being profitable. That there are also other causes which often consume the profits, it, of course, would be useless to deny; but in the waste alone, on nearly all roads, would represent an amount sufficient to make the difference between a profitable and an unprofitable investment. This is so universally admitted that it is not necessary to prove it. The problem is, how to stop the waste. Unless human nature is different from what experience usually indicates, it seems that some system such as we have proposed would cure the evil. Not much experience is necessary to show that it is much easier to propose an idea of this kind than to carry it out in practice. Plans similar to that suggestion have been tried from time to time and abandoned, but the failure of one or more experiments should not be taken as conclusive that the problem is incapable of solution. The skeptical reader who at this point is prepared to interpose his experience, or his "idee," is requested to give a little more reflection to the subject. That an imaginary plan, or one tried under certain circumstances, may, or has failed, does not prove that no other plan, or the same one under different relations, may not succeed. Remember, too, that what any one person knows about this subject is very far from all that could be known about it. The knowledge of any single individual is extremely limited, and because he cannot see how things could be done it is by no means conclusive that it is impossible. If the theory of such a plan is sound, then the difficulties are probably only questions of detail and practice, which a little experience and study may overcome. A skillful engineer in locating a railroad in a rough country, in advance, progress towards the perfection of the business

may find a mountain in his way, but he does not therefore abandon this line but tries another route. He will follow the water-courses, it need be, or turn the mountain, if no other expedient will answer. To our experienced friends, therefore, it is suggested, that they extend their study and experiments. If one has failed, follow it up and learn the reason why. A better understanding of the conditions of the question, or of the principles of co-operation (which, by the way, are not studied by our working men as much as they should be), may show the cause of the failure of such schemes. For years, ever since the invention of the steam engine, men who have always been regarded as somewhat unbalanced have been experimenting with steam carriages for common roads. The problem has always obstinately resisted solution. According to all mechanical logic the carriages should have worked well, but nevertheless did not. Recently the idea has occurred to some one to interpose an india-rubber tire between the rigid wheels and the inequalities of the road. Recent experiments have shown that this simple expedient is the secret of their successful use. Now is it not probable that the interposition of some sort of elastic medium between the rigidity of the employer and the inequalities of the employed is just what is needed to make an arrangement such as we have indicated succeed. It is to a very great extent a question of skillful organization. Its solution can be effected only by the exercise of sound practical experience combined with shrewd, penetrating, theoretical knowledge.

Two difficulties would, of course, be encountered. In the first place, the self-styled "practical," grasping, money-bags style of man, will never be able to divest himself of the absurd, barbaric notion, that if any one grows richer, therefore some one must grow poorer, and, consequently, if the men are making money, it must be at the expense of him who is a stockholder. We have not the time, nor is this the place, to refute this absurdity; but it prevails in many minds. The other difficulty will be, that in any scheme dishonesty will, of course, immediately commence to play its part. The means must therefore be provided to thwart this "little game," and any one studying the subject must keep this in view.

We have no distinct plan to propose, but only desire to call attention to the importance of the subject. We incline to the opinion that some system of contracts with men is possible. For example, a contract might be made with a locomotive runner and firemen for hauling freight cars, at so much per car per mile, they furnishing, or rather paying for, their coal, oil, waste, etc. Of course the rates would vary with different engines, and on different roads. Such a plan would very soon determine what is the most economical style of engine, and the most favorable conditions of their working, because the men would very soon learn which engines and what practice is most economical, and would be governed accordingly in making contracts.

There are, doubtless, a hundred objections which can at once be made to such a system, none of which do we propose to answer. The object in making the suggestion is to have our readers ask themselves the question whether the difficulties in the way of carrying out such a scheme cannot be overcome. The experiment might be tried, to a limited extent, with one engine, and the difficulties would then present themselves. As we said before, because one plan may fail, it is no cause for abandoning the whole idea. Skillful organization and study might overcome all seeming difficulties.

LEGISLATIVE REGULATION OF RAILROADS.

We desire to call attention to the article entitled "The Government and the Railroad Corporations," which occupies several pages of this number of the RAILROAD GAZETTE. The author, Mr. Charles Francis Adams, Jr., has made a special study of railroad management and railroad legislation, understands clearly the complexity of the subject and the extreme difficulty of settling it, and offers his suggestions as experiments worthy of trial rather than measures sure to succeed.

Mr. Adams takes it for granted that the State has the right and the power to regulate the charges for transportation. His endeavor is to point out means by which such regulations may be equitably adjusted. Mr. Adams recognizes the crudeness, injustice, impracticability and inefficiency which have characterized most of the State legislation concerning railroads intended to be restrictive. He recognizes, also, that many of the more recent developments in railroad management, such as the consolidation of lines and the formation of extended systems and combinations of different companies to prevent competition, which have been quite generally condemned as against public policy, are legitimate developments, steps in ad-

of transportation, necessary to the economical operation of lines, and desirable for the public as well as the stockholders of railroads, because in this way the first cost of transportation is reduced. Mr. Adams also recognizes the futility of all State laws intended to prevent consolidation. Formal consolidation—the union of two separate companies under one corporate name—may, perhaps, be prevented; but the combinations and harmonious operations which are the prime objects of most consolidations cannot be prevented. The law may prevent the union of the Illinois Central and the Chicago & Alton properties under one company, but it cannot prevent Commodore Vanderbilt from purchasing a controlling interest in each and then dictating the management of both. It cannot even prevent one company from purchasing all or a majority of the stock of the other, and thus manage through one man, or set of men, the business of the two companies.

In this article, also, we find the evils of competition recognized, chiefly, however, in the fluctuation of rates and not in the great addition to expenses which it causes.

But one of the results of these combinations is that State legislation is often rendered inapplicable or inefficient, as the systems may extend over half a dozen States, and the laws of any one will apply only to a fraction of a system. Hence it is concluded that the National Government must eventually assume jurisdiction over the railroads. This, however, is not thought probable or advisable for the present; experiments will be better made by the several States, and when experience shall have pretty well settled what legislation is practicable and desirable, it will be time enough for the general government to step in.

The three essential features of the development of our railroad system are thus tersely expressed: "the consolidation of connecting roads, obliterating State limits; the combination of competing roads evading State jurisdiction; finally, the concentration under corporate control of a degree of wealth and influence greater than any existing machinery of State government can control."

The great danger to the community arises from the latter. Abuses in the operation of a railroad of course become more serious in proportion to the extent of the railroad and its business; but it is also much harder to prevent them in a large and strong corporation than in a weak one. But this is not true of railroads or corporations alone. It has not been thought necessary to forbid the accumulation of capital, because such accumulation increases the possessor's power for evil. It may be true, however, that special laws and regulations are made necessary by reason of such accumulations.

The article discusses the possibility of the operation of railroads by the government in this country, and decides that management by a State is not likely to succeed, and that, with our present civil service, management by the general government would be almost sure to fail. It recommends, however, that an experiment be made by some State with a single line, as likely to be "of great illustrative value."

The solution of the difficulty is looked for with most confidence in the wise regulation of railroads by State authority.

The failure of legislation heretofore is charged upon the failure of legislators to perceive the exceptional position of railroads, and the want of governmental machinery adapted to their particular case. The new Illinois Constitution recognizes the exceptional position, but it does not provide the exceptional machinery. The Constitution directs the Legislature to fix reasonable rates for transportation and pass laws to prevent unjust discriminations and extortion. But if the Legislature is to do this work, then, says Mr. Adams, "the work cannot be 'done; the provision is so much waste paper. It may 'boldly be laid down as a principle, that no general 'law can be framed which will meet the exigencies of 'a whole railroad system in all its manifold details.' This is notably the case in rates of freights and fares. The rates charged should be in proportion to the cost, and this depends upon the capital invested and the amount and character of the business, which are very rarely the same on any two lines and often are very dissimilar. Mr. Adams' position is impregnable here. There will soon be less than a mile of railroad between St. Louis and East St. Louis which is to cost \$5,000,000. Shall traffic on this line pay no more than on a mile of railroad over the flat prairie a few miles further east which cost not more than \$20,000? Shall the Union Pacific, which on parts of its line receive hardly a car load of freight a month on a hundred miles of road, receive no more per ton per mile than the Reading Railroad, on which a train is rarely out of sight of the one preceding and the one following it?

Notwithstanding the difficulties—the impossibility of providing for special conditions by general laws, and the prohibition of special legislation—Mr. Adams still adheres to the policy of regulation, and the chief object of his article is to develop a practicable and effective plan for such regulation. He would have general restrictive laws as there are general laws against crimes, but each case arising under these laws he would have come under the cognizance of a tribunal specially created for that purpose, with judicial and discretionary powers, such as courts have with respect to crimes. This railroad commission would be a jury of experts, familiar with the principles of transportation as judges are familiar with the law, and held directly responsible for the administration of the laws.

This machinery is recommended especially to this State, whose Legislature is commanded by the Constitution to act on the subject, and where special legislation, which would be fatal to the efficiency of such a tribunal, is forbidden. It is quite different from the plan recommended or suggested by Governor Palmer, whose proposed railroad commissioners would be prosecuting attorneys rather than judges. But it is questionable whether the Constitution, strictly interpreted, will permit the Legislature to delegate its powers in this way to executive or judicial officers. "The General Assembly shall, from time to time, pass laws establishing reasonable maximum rates of charges for the transportation of passengers and freight on the different railroads in this State," is its language. It is quite true that if it attempts to do this directly it will fail, but is not certain that the railroad sections in the new Constitution do not prohibit the employment of the only means by which the regulations intended can be secured.

However this may be, Mr. Adams' article is worthy of the careful study of every member of the Legislature. If its recommendations cannot be accepted, at least its warnings should be heeded, and this Legislature will distinguish itself if it succeeds in abstaining from gross blunders in its railroad legislation.

Illinois Railroad Legislation.

So far, we believe, the only bill introduced into the Illinois Legislature proposing restrictions on railroads is one offered by Hon. Allen C. Fuller, of Belvidere, which proposes to make the maximum charge for the transportation of a passenger three cents per mile on all railroads in the State and punishing the third wilful violation of the law by a forfeiture of franchises. Companies are to be permitted to charge ten cents extra when fares are paid in the cars, provided that the fare is not made more than five cents per mile. This bill has been referred to the Senate Committee on Railroads and Warehouses.

No man who is familiar with the business of railroads in this State would, we think, honestly propose such a law. There is, we believe, no railroad in the State whose rates are so low, and it is unquestionably true that there are many roads in the State which do not with their present rates earn anything like the interest on the capital invested in them. If their freight rates should be reduced in the same proportion some of them would not earn their operating expenses. It is said that this route will be an average reduction of 25 per cent. With a similar reduction in freight and not passenger rates which are most complained of, the net earnings of most of our roads would be reduced nearly *sixty-five per cent*. The road which has had \$300,000,000 gross earnings would have a little more than \$1,000,000. A reduction of 25 per cent. in the receipts of the Wisconsin Division of the Chicago & Northwestern Railway last year would have left something like \$75,000 for the return of the capital invested in the 315 miles of road and the equipment of that division. It is doubtless true that there would be an increase of traffic with lower rates, but in many cases—and that last named is one of them—this increase would be very small.

The Legislature will make a sad blunder if it attempts to fix any general rate for all roads in the State. We commend to its notice what Mr. Adams says on this subject in his article on "The Government and the Railroad Corporations."

Since the above was written, the following report of a bill introduced into the lower house last Thursday has been received:

"Strong, of Livingston, offered a bill providing for the appointment, by the Governor, of three Railroad Commissioners, receiving \$5,000 per year each, whose salaries and all other expenses shall be assessed *pro rata* on the railroads, and whose duty shall be to have general supervision of all railroads, horse, steam, etc., and keep themselves informed as to their condition, how far they accommodate freight and passengers, comply with their charters, etc. They can require roads to change rates of fare or freight, to give increased facilities, add to the amount of rolling stock, change the man-

ner of operating road, etc. Upon any complaint made by county, town, or city authorities, relative to the management of any road, the commissioners must examine the matter, and must also examine upon petition of any twenty voters, or report reason why not made. Provision is made for a clerk, with a salary of \$2,000. On the occurrence of any accident, the railroad shall report the fact to the commissioner, who shall examine the same."

This is a union of the powers of prosecuting attorney and judge in the same body, but it recognizes the fact that uniform rates are impracticable, which is certainly a step in advance.

"Great Railroad Centers."

Atchison—or an Atchison newspaper—claims to be the "great railroad center" of Kansas and to have more than 1,200 miles of line radiating from that point. To make this statement good it claims to be the terminus of three railroads with 758 miles of line which have not even a station in Atchison, two of which do not approach within 20 miles. It has access to these roads through a ferry and another railroad, it is true, and so it has with nearly every other railroad of the 55,000 miles in the United States, and odd thousands in the British provinces.

The truth is that the importance of a place as a railroad center cannot be measured by the number of miles of road which is connected with it. A bridge across the Missouri would give Atchison as good an outlet to the East as any other Missouri River town, but this outlet would not be so available and profitable to the town as those of Kansas City and St. Joseph, unless it could offer so much business that the railroad companies would run their road directly through to that point from Chicago, as they have been doing from St. Louis.

This is what the town has to hope from the Chicago & Southwestern Road, in case it constructs a line to Atchison; but it will be easy enough to secure connections with lines to the East, constructed or projected, if the town has the facilities for drawing trade from the West. The future of Atchison, as of most Missouri River towns, depends upon their lines to the interior of Kansas and Nebraska. The lines to the East are now capable of transporting ten times the traffic the town can now give them. But such lines as the Central Branch Union Pacific, now extending 112 miles west of Atchison; the line to Topeka (now under contract) to connect with the completed part of the Atchison, Topeka & Santa Fe Railroad, extending 60 miles into Southern Kansas with plenty of room before it, and any other extensions or branches of these roads will bring business to Atchison which will make it grow.

Flint & Pere Marquette Railroad.

On the 28th ult., the fourth division of this railroad, extending from Clare westward 10½ miles, was opened with an excursion. The total length of the line from East Saginaw to its present terminus is 60 miles. The third division of 23 miles, from Averill's to Clare was opened last November.

The road was through a great forest chiefly of pine, with some hardwood which has been hitherto almost inaccessible. Now parties are lumbering all along the line of the road and sending the logs to the mills by rail. The East Saginaw *Courier* says:

"To do the business that has sprung up along this new line, two trains a day are now required, which go well loaded with passengers and freight, and the work which here invites capital and labor to a fruitful field, has but just commenced. It is estimated that in the nine townships of 16, 17, and 18 north, and 4, 5, and 6 west, through about the centre of which the road runs, there are 2,000 million feet of pine lumber. All of this timber either in logs or lumber must come to market over the Flint & Pere Marquette Railroad, and all the vast supplies necessary to prepare it for market must come from Saginaw. The greater portion of this land is owned by the lumbermen in the valley, but the railroad company have lands, upon which there are about 250 million feet, that are in the market for sale."

"The aggregate amount of land reserved for the company by the General Land Office at Washington is 511,492 acres, of which have been sold up to December 29, 1870, 113,941 51-100 acres, at an average price of \$7.15 per acre. The number of sales in the aggregate is 352, and of these there have been made in 1870, to 29th December, sales embracing 30,451 1-4 acres at an average price of \$8 per acre. The collections on these sales to 1st Sept. were \$393,685.71."

These collections are applied solely to the purchase of the company's 7 per cent bonds for cancellation, for which \$9 has been the least price received. The road is to be extended as soon as possible to Crooked Lake, 2½ miles, which is an important lumber station.

This road has grown somewhat slowly. The first section was 26½ miles from East Saginaw to Mount Morris, opened in January, 1862; then 7½ miles from Mount Morris to Flint. It was made a complete line by the opening of the line from Flint to Holly, 17 miles, in November, 1864. This part of the road, 51 miles long, in connection with the Detroit & Milwaukee road, forms

a direct route between Detroit and East Saginaw, 98 miles long. This part of the road extends from Holly but a little west of north; thence the course of the road is nearly due northwest. Of this, 20 miles, from East Saginaw to Midland, was opened in December, 1867; 6½ miles further, to Averill's, just a year later, and the rest, as we have said, during 1870. It has, besides, a branch from East Saginaw north along the east bank of Saginaw River to Bay City, 18 miles. The main line will extend nearly due west from the present terminus through Osceola Lake and Mason counties to Ludington on Lake Michigan, at the mouth of the Pere Marquette River. Of this 6 miles are nearly graded and are to be opened early in the spring, and 22 miles more are to be constructed during the present year, to a connection with the Grand Rapids & Indiana Railroad near Hersey, in Osceola county, four or five miles beyond its present terminus at Paris. There will then remain 61 miles to complete the line to Lake Michigan.

Besides this extension westward, the Flint & Pere Marquette Company has also made a contract to complete the construction of the Monroe, Wayne & Holly Railroad, 63½ miles long, during the present year. This will give it an outlet to Toledo by the most direct line, and through the Detroit & Howell Road, also to be constructed next year, it will have a new outlet to Detroit.

This road and the part of the Indiana & Grand Rapids Railroad north of Grand Rapids are instances of railroads constructed through unsettled, heavily-wooded sections. It will be interesting to know whether these will attract settlers and develop business as rapidly as the numerous railroads that have been constructed in new prairie countries.

Railroads in Illinois.

The *American Railroad Journal*, in an article which we copy elsewhere, gives the total length of railroads completed in Illinois as 5,423 miles. In another table it gives the name and length of each road separately, and forms the total by adding the length of these, and to the sum 600 miles as the length of roads "in progress and recently opened, and a large number of mineral roads." We have noted the omissions in its table, so far as we are able, and find them to amount to about 400 miles. On the other hand it reckons about 170 miles of road not yet completed. This would leave but 230 miles, instead of 600, as the margin. We may have omitted some short sections of road but not many. There are not many, indeed, there are scarcely any, "mineral roads" in the State, not enough to make one hundred miles of line, we are confident.

However, if we deduct 200 miles from the total reported by the *Journal*, we shall have still 5,200 miles of railroad in the State, or very nearly one-tenth the mileage in the Union, while we have about one-sixteenth of the population.

"The Northwestern Railroad in Dakota."

This is the heading which an Eastern railroad journal gives to the announcement of the completion of the St. Charles Branch of the Northwestern. St. Charles will be astonished to learn that it is in Dakota instead of Illinois, six hundred miles from Chicago instead of thirty-eight. The blunder probably is due to the telegraph, as the announcement is made in the form of a telegram, with the heading, "Yankton, December 29."

NEW PUBLICATIONS.

The Iron Age, which has been heretofore one of the largest, handsomest and fullest of trade journals, comes to us now with the addition of a column to each of its eight pages. It now gives 64 long columns weekly. This journal is of special value for the very full and accurate reports of the hardware and metal markets which it gives, which make it, we should say, indispensable to hardware and metal merchants and all who purchase largely of metal and their manufactures. It is published at No. 80 Beekman street, New York, by Daniel Williams, and the price of subscription is four dollars per year.

Van Nostrand's Engineering Magazine for January has an interesting biographical sketch of Jesse L. Williams, of Fort Wayne, Ind, from advance sheets of Stuart's "Civil and Military Engineers of America," soon to be published. A part of the very interesting report of a committee of the trustees of the Rensselaer Polytechnic Institute on the system of instruction in that institution, and a large number of well selected articles on metallurgy, civil and mechanical engineering, and meteorology. The publisher announces, what the reader will be glad to hear, that more space than heretofore will be devoted to short discussions or elucidations of important formulæ, especially such as have proved valuable in the practice of working engineers; our facilities for affording such items are extensive and rapidly increasing.

Chicago Railroad News.

Chicago, Burlington & Quincy.

This company intends to commence operating the new line from Aurora through Ottawa to Streator next Monday, and run regular freight and passenger trains over it.

Chicago, Rock Island & Pacific.

A slight reduction of first-class passenger fares between this city and some points on the road has been arranged to take effect next Monday. The new rates will be, between:

Ottawa and Chicago	88.10
Utica " "	3.50
La Salle " "	3.70
Peru	8.75

Lake Shore & Michigan Southern.

This company has become so thoroughly convinced of the excellence and economy of the Westinghouse atmospheric brake, which it has used for several months on one train, that it has ordered it for the entire passenger equipment.

West Chicago Street Railroad.

The annual meeting of this company was held last Tuesday. The following report of the property and business of the road was made:

Number of stables, car houses, and car repair shops owned by the company	10
Number of horses	483
Number of cars	75
Number of miles of track	27
Number of miles of track renewed during the year, with new iron	4
Miles of track laid during the year, with new iron	3
Miles of track laid during the year, with old iron	1
Total trips made during the year	394,680
Total miles run	1,085,370
Total passengers carried	8,551,984

The following persons were elected directors: William H. Bradley, John C. Haines, S. B. Cobb, B. H. Campbell, Nathan Corwith, Jerome Beecher, and William H. Ovington.

Chicago & Northwestern.

It is announced that the company will commence running trains regularly to and from St. Charles on the 16th inst. The Geneva accommodation will thereafter be the "Geneva and St. Charles accommodation," leaving Chicago at 5:30 p. m., reaching Geneva at 7:00 p. m., as now, and St. Charles at 7:15 p. m. Returning, it will leave St. Charles at 7:00 a. m., Geneva at 7:15, as now, and reach Chicago at 8:45 a. m. Thus St. Charles is brought within an hour and three-quarters of Chicago. Doubtless it will hereafter become the residence of some Chicago people. The country between it and Geneva, on the line of the road and along the banks of Fox River, is very beautifully situated, and is likely to be divided up into tracts of several acres each, for those who wish something larger than even the most liberal grounds in country towns.

The rates of fare and freight to St. Charles are to be no greater than to Geneva, according to the terms of the lease. This is the consideration for which the company gains the use of the road, no money rental or proportion of earnings being paid.

It is intended to have cars run to St. Charles in connection with the Clinton passenger train in a few months, we understand.

Michigan Central.

Next Monday this company will commence running trains on the Michigan Air Line between Niles and Jackson. For the present there will be one passenger train running through it in connection with the mail train over the old road, a local freight running from Niles to Jackson one day and from Jackson to Niles the other, and an accommodation train running between Niles and Three Rivers in connection with the Kalamazoo accommodation from Chicago.

The following are the stations on this line with their distances from Jackson:

Jackson	0 Colon	53.5
Spring Arbor	10.2 Centerville	64.0
Concord	14.6 Three Rivers	69.2
Homer	28.6 Vandalia	84.6
Tekonsha	38.2 Cassopolis	89.4
Union City	41.4 Barren Lake	99.6
	Niles	103.1

By the old line the distance between Niles and Jackson is 15 miles.

The report of the earnings for December on the main line is given elsewhere in the "Register of Earnings."

The earnings of this line and all its branches for December were as follows:

1870	8425,735 21
1869	850,376 59

Increase. \$43,358 63

There has been a large increase in mileage during the year, the Grand River Valley Road, 94 miles long, and about 30 of the Kalamazoo & South Haven being operated by the Central in December, 1870.

Illinois Central.

This company makes its current semi-annual dividend of 5 per cent. in gold, which gives the stockholders, four-fifths of whom reside in England, a certain sum, not likely to change in value before it could be transmitted.

Chicago & Alton.

The company is now running trains on what is known as the "Western Division," regularly to both Washington and Lacon. This division consists of a line from Dwight nearly due west, through Streator and Wenona, to Lacon, on the Illinois River opposite Sparland station on the Peoria branch of the Rock Island road, and a branch diverging from the Dwight & Lacon line at Varna, 9½ miles west of Wenona, and

extending southward 25½ miles to Washington. The latter is intended to extend eventually to a connection with the Jacksonville Division at Delavan or Hopedale. The total length of this division is 70 miles. The following is a list of the stations and distances:

STATIONS.	Distances from Dwight.	STATIONS.	Distances from Dwight.
Dwight	0	Varna	44.3
Nevada	7.4	Lacon	44.3
Blackstone	13.9	Montrose	48.3
Smithdale	18.4	Washburn	53.7
Streator	22.3	Cazenovia	58.9
Bradford	26.2	Metamora	63.2
Garfield	29.4	Washington	69.8
Wenona	34.8		

Trains on this division run through between Dwight and Washington, an accommodation train running between Streator and Lacon. Between Dwight and Washington there are one freight and one passenger train each way daily.

Capitalizing Earnings.

A very suggestive paper has been this week put in circulation in Wall Street, exposing the practice which has been of late abused by some of our railroad corporations, of capitalizing their earnings, or adding to their share capital in proportion to the growing business of the road and its consequent enlargement of income. The New York Central & Hudson River Railroad is the one selected as an illustration; and the writer shows that since 1867 an increase has been made to the capital of these two railroads amounting to no less a sum than \$48,684,200. On this watered stock, dividends are paid; and the point is whether these dividends have been honestly earned. Into this question the pamphlet does not enter, although it tells us that the dividends on the new shares wring from the public, in addition to the proper charges of transportation, a tribute of nearly four millions a year, and that this tribute is levied upon food—upon the necessities rather than the luxuries of life—and that its pressure falls chiefly on those citizens who are least able to pay.

Mr. Vanderbilt, in reply, says that the earnings of the road fully justify the addition to the stock, and he challenges the most rigid inspection of the accounts of the road, declaring that the net earnings are fully equal to eight per cent. on the whole capital as it now stands, and denying that at any time during his management recourse has been had to the disreputable and dishonest financial expedient of paying dividends out of capital. We have carefully examined at various times the sworn statements of the financial condition of the New York Central & Hudson River corporation, and we are to say that the Commodore's assertions appear to be sustained. Experienced railroad financiers, who are above suspicion of dishonest bias, have assured us that they have arrived at the same conclusion. Still it must be regretted that the "construction account" is so large; and if Commodore Vanderbilt is sincere he ought to have this account closed forthwith.

As to the other charge of "wringing excessive charges" from the public, we are pointed to the fact that the passenger rates are fixed by law, and cannot be increased; while the rate on freight is fixed by the severe competition between various railroads. This competition is, in fact, the great bulwark of the public against the rapacity of the railroads; and Commodore Vanderbilt will not, we suppose, deny that he has done his best to end that competition; and that several times he has seemed to be at the very point of amalgamating the various roads leading from the great lakes to the sea-board. It is, indeed, one of the redeeming features of the erratic maneuvers of the "Erie men," that they checkmated the Commodore in 1868, when he seemed surest of his success in his scheme of amalgamating the Erie and Central roads, and that these victorious Erie champions have ever since kept the baffled Commodore at bay. Much of the popularity, which, in spite of their misdoings, the Erie clique have undoubtedly enjoyed, was founded on this fact, that the public regarded their fight as made for the destruction of a scheme by which Mr. Vanderbilt would have stopped healthy competition in transportation, and raised up a gigantic railroad monopoly, hostile to the public, destructive to commerce, and interested only in getting the greatest possible gains and rendering the least possible service in return.

The pamphlet before us gives the history of the several "waterings" by which stock of the Central & Hudson corporation was raised from thirty-three millions in 1854 to its present magnificent proportions of ninety millions. We suppose that all choice real estate in this State has risen in a similar degree in valuation; and we do not see why Congress should interfere, as is here recommended; or why a railroad company, if it kept within the limits of the law and equity, should not be as free to put its own nominal valuation on its road as the owner of a house to set upon its own valuation without let or hindrance. If a railroad company water its stock beyond its power to pay dividends, then the price will fall in the market, and, like the Erie shares three years ago, it may sink to an almost nominal price. The fear of such a catastrophe is one of the best preventives which is possible in a free country like our own. Another check on this over-abundant enlargement of the stock is given by the press. In this journal, for example, we take special pains to make public all the changes of this sort which affect the value of the one thousand millions of railroad shares which are afloat in this country. The facts about the Vanderbilt roads, as they are called, have been repeatedly exposed in our columns, and in 1867 we warned the public against supposing that the Hudson stock, when doubled, was increased in its real aggregate value

by one dollar more than the fifty per cent. subscription which was called up on the new shares. Similarly in 1868 we exposed the true nature of Mr. Vanderbilt's much lauded scrip dividend of eighty per cent. on the share capital of the New York Central road, then \$28,730,000; but raised by this financial maneuver to nearly \$52,000,000. Again at the consolidation of the two roads, when the aggregate capital was raised to ninety millions, we enlightened the public as to the true nature of the transaction. Multitudes of other journals did the same, and with the real facts before him, it is the investor's own misfortune, if not his fault, if he is misled into the wrong estimate of the value of this property.

We repeat, then, that we cannot approve of an appeal to Congress to stop this sort of bad financing on the part of railroad corporations. All that is wanted is the keen, illuminating force of publicity upon all the dark doings of railroad magnates, and caution the investing public to guard themselves from this and from any other public nuisance or personal danger. It is also untrue that this excessive watering of stock of which other railroads besides those of Mr. Vanderbilt have been conspicuously guilty, prove that our financial system is rotten and dangerous, and that it is liable at any time to produce a panic. Such statements can have no force except with credulous and timid ignorance. Our railroads now extend their network of 50,000 miles throughout every part of this continent. They traverse its rich valleys, climb its steepest mountains, reach across its broadest rivers, and bind the vast territory of the United States in one grand organism, which is increasing more rapidly in wealth and productive force than any other country in the world. Every mile of new railroad adds four times its cost to the value of the surrounding property, and by a compensative and sure reaction the growing value of the real estate bordering a railroad, gives new and enhanced value to the railroad itself. What if a few of the corporations, tempted by their rapid progress, are found traveling faster than they should! Let us deal severely and justly with each case as it arises, and recognize in all these waterings of stock an exaggerated, and, in some respects, a mischievous illustration of the fact that our railroad property is growing in annual value with a rapidity unknown in any other age and country than our own.—*Commercial and Financial Chronicle*, Jan. 7.

Completion of the Mont Cenis Tunnel.

Of the several great engineering feats brought to successful completion during the last few years there is hardly one which is more wonderful in its conception and execution than the Mont Cenis tunnel. It is noteworthy that the three wonders of the decade which expires with the present week have all been works to improve the means of transportation round the world. The longest line of railway in the world has connected the Atlantic with the Pacific, and rendered unnecessary the passage around Cape Horn, or even that shorter sea voyage by way of the Isthmus of Panama. The most stupendous canal in the world has connected the Red Sea and the Mediterranean, and abolished the Cape of Good Hope. The completion of the longest tunnel in the world fitsly closes the record of the decade, connecting as it does the railway systems of two great countries, and forming a link in a connected track of uniform gauge stretching from Calais to Brindisi. There are other great works in progress in various parts of the world, but none that will compare for magnitude with these three. In boldness of conception neither of the others is so startling as the latest. If the scene was dramatic when a long procession of ships steamed through from the Mediterranean to the Red Sea and back again, if the meeting of construction parties starting from opposite sides of the continent, and joining their iron rails on the summit of a mountain, could draw forth a superabundance of eloquent declamation, what shall be said of the union of two parties burrowing through the solid rock of a mountain for seven miles, and meeting in the bowels of the earth ten thousand feet below the surface? There surely was never before such a meeting. Witnessed by few, the scene can never be forgotten by those whom the weird lights of the tunnel first revealed each to the other. The rocky cavern, where the last blows are struck that made way beneath the mountain, was no place for such a scene as when the last spike was driven on the Pacific Railroad, or for a gorgeous pageant like the march of the ships through the Suez Canal; but the event will be not less nobly celebrated by all who are proud of so great a triumph of the human mind.

A history of the great work would fill a volume. As long ago as 1852 this tunnel was proposed by Mr. Chevalier Maus, who advanced the idea that with a machine of his own invention a progress of a mile and a half a year might be made. So great progress as this has never been made even with the improved machines of the present day, which bear no resemblance to those of the Chevalier Maus. The project slumbered until 1857, when, plans and estimates having been made, work was begun. The total length of the tunnel was to be 12,220 meters, or 7 miles, 1,020 yards, reaching from the village of Fourneaux, in Savoy, to Bardonneche on the Italian side. At first, and until 1861, the work was prosecuted wholly by hand-labor. The progress was very slow. In the latter part of 1857 and during the whole of 1858, there were pierced but 497 meters, a rate which would have required twenty-five years of work to finish the tunnel. During the four years and a fraction up to the close of 1861 the total progress at both ends was only 1,575 meters, or nearly exactly one-eighth of the aggregate to be pierced. In the year 1861 experiments were begun at the Bardonneche end with compressed air, and they were so successful that by 1863 this agent had been introduced at both ends, and it has ever since been employed exclusively. The progress for 1862 jumped to 623 meters, for 1863 to 802 meters, and it has increased still further as the work

has advanced, the distance for this year being 1,621 meters, or nearly one-seventh of the whole. The tunnel does not run beneath Mont Cenis, as its name would indicate, but to the westward of that peak. It starts at Fourneaux, in the valley of the Arc, in Savoy, at a point 3,946 feet above the sea, and proceeds at an ascending grade of one in forty-five to the point of meeting with the other heading, and thence by a descending gradient of one in two thousand to Bardonneche in Italy, 4,381 feet above the sea. In 1868 the work was given out by contract to Messrs. Sommeiller & Grattom, who had been connected with the tunnel from the first, and who then agreed to complete the work by the close of 1871, with a forfeit for every month afterwards and a bonus of equal amount for every month saved. As they will be able to finish the tunnel in a few months, probably they will receive quite a handsome sum as bonus. The actual termini of the French and Italian railroads are St. Michel and Susa, and the work of connecting these points with the ends of the tunnel has been one of great difficulty and attended with enormous expense. It was estimated to cost at the rate of \$360,000 per kilometer for the road between Bardonneche and Susa. We have no data as to the actual cost of this outside work, which has not been completed; nor has the total expense of the tunnel been summed up as yet; but up to the close of 1878 it had eaten up more than forty-seven million francs, and this has probably been increased to sixty-five millions at the present time. It has, however, grown cheaper proportionally as the work advanced. The 363 meters pierced in 1861 cost three million francs—half as much as the 1,512 meters which represented the work for 1867. Through the whole distance the rock has been schist, quartz and limestone, the first predominating largely. What time and labor were lost by the hardness of the quartz was more than made up by the ease and speed with which the limestone was pierced. The completion of the tunnel and the connecting road will open a line 1,390 miles in length, connecting the English Channel with the Adriatic.

The successful completion of the Mont Cenis tunnel is full of encouragement for all who are interested in the similar great work in our own State, which is inferior in magnitude to it only. The difficulty of determining the proper direction of the two ends, and of continually renewing the points laid down for the guidance of the miners, can only be appreciated by those who have had such a work imposed upon them, but no one would esteem it an easy task. That it not only may be done but has been done, that the distance may be accurately estimated and the direction so accurately determined that two parties working from opposite ends shall at last hear through the heading the clicking of each other's drills—these facts are sufficient to quiet the fears of all who dread a useless expenditure of money by working in a wrong direction. The Hoosac tunnel, bored through by the energy of a single State of the Union, will be to us a greater monument than the slightly longer, but not more difficult tunnel, for the construction of which the treasures of two great governments have been freely opened. With them, it was to overcome an obstacle otherwise insuperable; with us, it is to add a second avenue whither we already have one, and a good one. We may well boast that if the skillful engineers of the Old World first made use of the powerful agent which moves the drills, it was American ingenuity which brought the machines to perfection. The success of the tunnel under Mont Cenis is a triumph for the Hoosac tunnel, and with the marvellous progress now making we shall not be long behind the French and Italians in rejoicing over a finished work.—*Boston Advertiser*.

Review of the Rail Market in 1870.

Bigelow & Johnson of New York, give the following review of the trade in rails in 1870:

New Rails.—The import during 1870 has again been large, its proportions being even greater than 1869. During the early part of the year and until the outbreak of the war prices of foreign were on a steadily ascending scale, reaching their highest point in June, at which time everything pointed to a prosperous fall with still higher prices, but the immediate effect of the outbreak of hostilities was to blast at once all such expectations, and prices have for six months been on the decline, with considerable irregularity, according as the prospects of peace rose or fell. As the market now stands, the margin between foreign rails and those of American make is very wide, and, should the war continue much longer, it is evident that the competition must soon become very severe. To meet this successfully some considerable reduction in material would seem to be necessary even beyond what the reduced price of pig iron affords.

Old Rails.—The demand for this class of imported material has been large and constant, and prices have advanced during the year from \$38, gold, to \$39 1/2 @ \$40, with occasional sales at even higher prices. The consumption has been general with, we think, considerable increase in the area over any former year. Hardly ever has there been any excess of supply and there is probably no article entering largely into our manufactures which has met so ready a sale, evinced by the large import which will probably reach nearly 110,000 tons in the aggregate. That this has proved a great boon to our rolling mills is unquestionable, and has neutralized to a great extent the inconvenience arising from the inadequate supply of puddled bars; and any increase of the duty, as at one time threatened, would have been a direct injury to such of our mills as are dependent on the open market for material.

It will be observed that notwithstanding the increase in the gold price, the equivalent in currency now ruling does not vary materially from that of last year at same time. At that time gold was 120, and rails \$38, equal to \$43.19, against present prices, \$39; and gold

110 1/4, equal to \$43.19, currency. In quoting these prices we refer to the figures current for DH in round contract lots, for forward delivery, the bulk of the sales having been made in this way. That this should exist in the face of a decline in the currency price of the article made from them, is evidence enough of the utility of old rails as raw material. During the past month the demand has slackened materially, and but for the fact that the supply abroad is not plentiful, prices would have yielded. The low price of pig-iron has led many mills to increase the number of their puddling furnaces, and it is evident that the supply from these sources will displace old rails to a certain extent, unless the demand for New Rails increase *pari passu*. This will be particularly the case with mills situated at a distance from the seaboard upon which the inland freight bears heavily.

AVERAGE GOLD PRICE OF OLD RAILS, N. Y., 1870.		
Months.	DH ² .	T.
January.	\$36 00	\$35 89
February.	36 50	36 50
March.	37 50	37 50
April.	39 00	38 00
May.	39 00	38 50
June.	39 50	39 25
July.	39 50	39 00
August.	39 50	39 00
September.	39 50	39 00
October.	39 50	38 00
November.	39 50	39 00
December.	39 50	39 00
	Gold.	Currency. Import, tons.
NEW RAILS.		
English.....	\$35 @ \$56	
American.....	\$35 @ \$70	
OLD RAILS.		
Double Heads.....	39 @ 39 1/2	
T or Flange.....	39 1/2 @ 39	
U or Bridge.....	Nominal.	4,010
Total Import in December.....		4,010
Import since January 1.....		50,697
Total to date.....		54,707

The Efficiency and Durability of Plain Cylindrical Boilers.

The *English Mechanic* gives the following report of a paper on the above subject, by Jeremiah Head, of Middlesbrough:

The writer states that his object is to call attention to many high qualities possessed by the plain cylindrical type of boiler, qualities which are, however, counterbalanced by certain serious defects. He proposes to investigate the cause and extent of these defects, and to point out satisfactory remedies. Anticipating the objections of those who are likely to urge that plain cylindrical boilers are wrong in principle, and ought to be entirely superseded, he submits that new enterprises, under the most unexceptional management, still continue to be furnished with these, in preference to other kinds of boilers, and were this not the case, the number in use is sufficient to give importance to any plan whereby greater efficiency and durability are likely to be secured. Out of 17,825 boilers now on the books of the various insurance companies, 4,052, or 22.7 per cent. of the whole, belong to the class referred to. They are, however, differently regarded in different districts, the proportion varying from 12 1/2 per cent., as reported by the Manchester Steam Users' Association, to 69 per cent., as returned by the northern district of the Midland Steam Boiler Inspection and Insurance Company. The writer next describes and illustrates the details and arrangements connected with an ordinary plain cylindrical boiler, dwelling upon their simplicity, ease of examination and repair, and small first cost. Excluding brickwork and fittings not riveted to the boiler, a 50-horse power boiler, or one capable of evaporating 50 cubic feet of boiling water per hour, would cost, according to present market price, about £100. To accomplish the same duty, an internally fired boiler would cost nearly three times that amount, and the saving of fuel effected by it would only be about 9 per cent. He, therefore, asks how it is that many are prepared to adopt the more complex appliance, at nearly three times the outlay, unless there is some further reason for such preference? The reply to this question may be expressed in homely language in a very few words. Plain cylindrical boilers are liable to break their backs. The manner in which the serious fractures so described destroy the structures is next illustrated. They do not occur in the region of the most severe heat, but, on the contrary, where the plates are unscaled and retain their original appearance. They can only be due to heavy tensile strains. The writer has often observed that the ends of boilers are apt to lift themselves up clear of their supports, leaving the whole weight—say, including water, 16 tons—upon one bearer alone. This happens when the boiler is at work, and is owing to the superior heat and greater expansion of the bottom of the boiler as compared with the top. On withdrawal of the fire and release of the steam the boiler ends were observed to return to their bearings and the center to show an inclination to arch itself clear of its support. In the former case, the bottom of the boiler must have been subject to severe compression, and in the latter to tension. The ultimate result of such a state of things could not be other than fracture across the weakest seam. The average difference of temperature between the top and the bottom of externally fired boilers is next estimated, and the difference in expansion computed. A boiler 45 ft. long when at work constantly endeavors to lift its ends something like 3 in. By reason of its own weight, that of the water within, and the rigidity of the structure, it is prevented from changing its form to that extent. It is, therefore, only by compression of the bottom plates and exclusion of the top that the forces brought into play can be absorbed. So much for expansion of the bottom when the boiler is at work. But what takes place when it becomes cool? Has it become permanently elongated? Does it return exactly to its original length? Or is it permanently contracted? If the latter—that

is, iron heated and cooled in contact with water—contracts every time the operation is repeated, then at the end of every week the bottom of a boiler must evidently become shorter, and the whole structure must ultimately either arch itself up clear of the middle support, or must break across the bottom. To satisfy himself respecting the behavior of iron under these circumstances, the writer made a series of experiments upon strips of boiler plate, fitted to a gauge exactly 1 foot in length. These strips were carefully heated to a temperature of about 80 deg., and then slackened in boiling water. This was intended to imitate the condition of the bottom of a boiler at work and off work, as at the end of a week. One strip was so heated and cooled 20 times; a second, 40; a third, 60; a fourth, 80; and a fifth, 100 times. The result evinced a small but steady permanent contraction, amounting in the last case to 1/4th of an inch. The writer contends that these facts entirely account for the fracture of boilers as described, and that the same fate must eventually befall all which are externally fired, provided they are so set as to be unable readily to assume new forms. He next submits his plan for removing the evil, which is to substitute yielding for rigid supports. He recommends that boilers should be hung upon evolute springs, and illustrates how this may most readily be done. The alteration and expenses entailed appear to be but slight. Besides the length-

ening of the suspension rods, and the introduction of the evolute springs, the connection between each boiler and the general mains must be made circuitous, instead of direct, in order to avoid risk of breakage from too much rigidity, and appliances called gags are made use of, in order to prevent too much rise and possible disturbance of brick-work when the water is released. This is all that is necessary to produce the desired effect. A boiler so altered has been at work at Middlesbrough since the beginning of March. The lifting at the end supports, which are 10 feet each from the centre, is found to be 1/2 in. The best way to support boilers of various lengths is next considered exhaustively, and the methods recommended are set forth in a number of illustrations. The amount of lifting at any point is shown to increase as the square of the distance from the center. No springs are necessary for boilers 30 feet in length upon two supports, but for the lengths of 60 feet to 75 feet, five supports are required, the end ones being furnished with double springs. Lest any should still be found to doubt the seriousness of the evils treated of by the writer, he concludes by quoting the experience of several engineers of boiler insurance companies and others, whom he has consulted while his paper was in course of preparation. The general tenor of their observations seems to confirm the writer's views as to the

magnitude of the evil, but betrays a great want of unanimity as to the probable causes and appropriate remedies.—*English Mechanic*.

The famous frog which was put down by the Delaware, Lackawanna & Western Railroad, some time ago, to connect their Croton branch of the Morris & Essex Road with the track through the Bergen tunnel, and which was torn up amid some excitement, has been restored to its place by the Erie managers, who thus express their acquiescence in the recent decision of Chief Justice Bradley.

—During the stoppage of navigation this winter, the depth of the channel of the Pennsylvania Canal is to be increased to six feet, or two feet beyond the present dimensions.

PUBLISHER'S ANNOUNCEMENTS.

Railroad Gazette.

As has been heretofore announced, the subscription price of the *Gazette* for the year 1871 is \$4.00. We are in receipt, since the first of January, of many remittances of \$3.00—the new subscribers apparently not being aware of our change of rates. Such subscribers will receive credit for but three-fourths of the year.

WANTS.

WANTED—A complete file of the *RAILROAD ADVOCATE* published in New York by Zerah Colburn about 15 years ago. A purchaser can be found by applying at this office personally or by letter.

WANTED—Every Railway Traveler in the United States and the Dominion of Canada wants every railway company to use the Thomas Safety Baggage Check. It is in use on over sixty of the best managed roads in the country and has been during the past three years, and not one piece of baggage to which this check has been attached has been lost or miscarried. Every railroad man upon whose road it is in use says:

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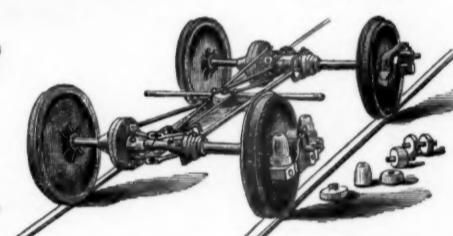
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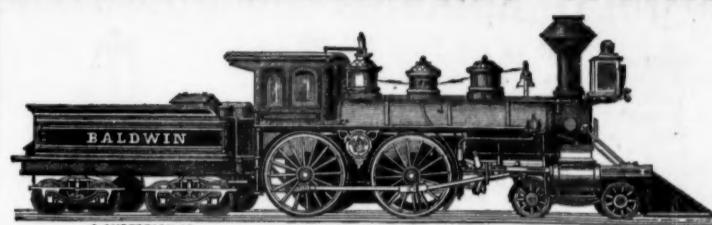
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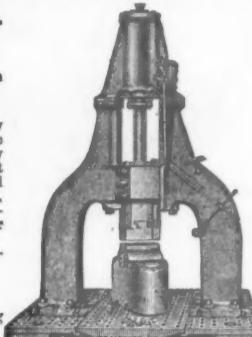
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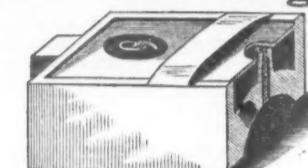
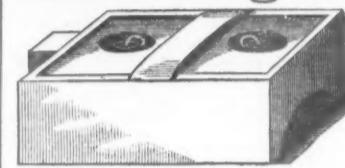
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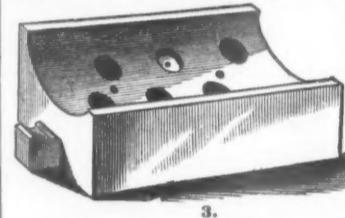
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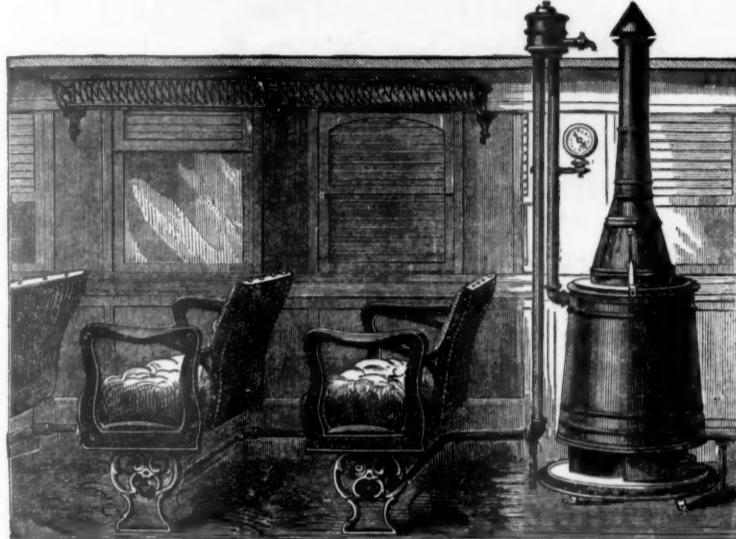
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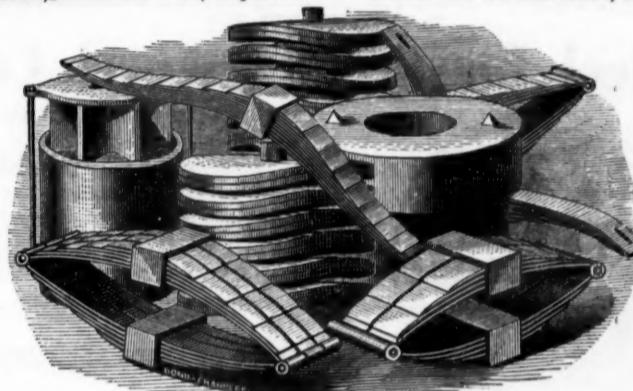
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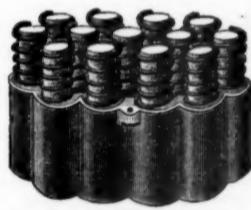
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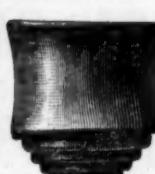
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6:10 P. M., Lombard Accommodation.

5:50 P. M., Junction Passenger.

TRAIN ARRIVE:—Freeport Passenger, 2:30 p. m., 6:40 a. m.; Rockford Accommodation, 11:10 a. m.; Geneva and Elgin Accommodation, 8:45 a. m.; Junction Passenger, 8:10 a. m.; Lombard Accommodation, 6:50 a. m.

WISCONSIN DIVISION.

Trains leave Depot, cor. West Water and Kinzie Sts., daily, Sundays excepted, as follows: 10:00 A. M. DAY EXPRESS, for Janesville, Monroe, Whitewater, Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Neenah, Appleton, and Green Bay.

3:00 P. M., Janesville Accommodation.

5:00 P. M. NIGHT EXPRESS, for Madison, Prairie du Chien, Watertown, Minnesota Junction, Portage City, Sparta, La Crosse, St. Paul, and ALL POINTS ON THE UPPER MISSISSIPPI RIVER; Ripon, Berlin, Fond du Lac, Oshkosh, Menasha, Appleton, Green Bay, and THE LAKE SUPERIOR COUNTRY.

5:30 P. M., Woodstock Accommodation.

TRAIN ARRIVE:—7:00 a. m., 7:15 p. m., 9:00 a. m., and 2:05 p. m.

MILWAUKEE DIVISION.

MILWAUKEE MAIL. 8:15 A. M.
 EXPRESS, (ex. Sun.) Waukegan, Kenosha, Racine and Milwaukee. 9:45 A. M.
 EVANSTON ACCOMMODATION. 1:00 P. M.
 HIGHLAND PARK PASSENGER. 6:20 P. M.
 MILWAUKEE ACCOMMODATION, with Sleeping Car attached. 11:00 P. M.
 KENOSHA ACCOMMODATION, (Sundays excepted) from Wells St. Depot. 4:10 P. M.
 AFTERNOON PASSENGER. 5:00 P. M.
 WAUKEGAN ACCOMMODATION, (except Sundays) from Wells St. Depot. 5:30 P. M.

TRAIN ARRIVE:—Night Accommodation, with Sleeping Car, 5:00 a. m.; Day Express, 4:15 p. m.; Milwaukee Mail, 10:30 a. m.; Afternoon Passenger, 7:40 p. m.; Waukegan Accommodation, 8:25 a. m.; Kenosha Accommodation, 9:10 a. m.; Evanston Accommodation, 3:30 p. m.; Highland Park Passenger, 7:55 p. m.

PULLMAN PALACE CARS ON ALL NIGHT TRAINS.

THROUGH TICKETS can be purchased at all principal Railroad Offices East and South, and in Chicago at the Southeast corner of Lake and Clark Streets, and at the Passenger Stations as above.

H. P. STANWOOD,
 Gen. Ticket Agt.

JOHN C. GAULT,
 Gen'l Supt.

Milwaukee & St. Paul R. W.

THE ONLY ALL RAIL LINE TO

ST. PAUL AND MINNEAPOLIS!

AND ALL PORTIONS OF

Wisconsin, Minnesota & Northern Iowa.

PURCHASE TICKETS VIA MILWAUKEE.

Passengers Going via Milwaukee,

Have Choice of Seats in Clean Coaches, and on Night Trains, a full night's rest in Palace Sleeping Cars.

■ BAGGAGE CHECKED THROUGH BY THIS ROUTE ONLY! ■

PASSENGERS FROM CHICAGO can obtain these Advantages only by the MILWAUKEE DIVISION of the CHICAGO & NORTHWESTERN R. R.

SPECIAL NOTICE.—Passengers destined to any place in Wisconsin, Minnesota, or Northern Iowa, either on or off the Lines of this Company, who cannot procure Through Tickets to their destination, should purchase their Tickets TO MILWAUKEE, as this is the Great Distributing Point for these States.

A. V. H. CARPENTER,
 Gen. Pass. Agt. Milwaukee.

S. S. MERRILL,
 Gen. Manager, Milwaukee.

CHICAGO, ROCK ISLAND & PACIFIC RAILROAD.

■ THE DIRECT ROUTE FOR ■

JOLIET, MORRIS, OTTAWA, LASALLE, PERU, HENRY, PEORIA, Lacon, Geneseo, Moline,

ROCK ISLAND, DAVENPORT, Muscatine, Washington, Iowa City, GRINNELL, NEWTON, DES MOINES,

COUNCIL BLUFFS & OMAHA!

CONNECTING WITH TRAINS ON THE UNION PACIFIC RAILROAD, FOR

Cheyenne, Denver, Central City, Ogden, Salt Lake, White Pine, Helena, Sacramento, San Francisco,

And Points in Upper and Lower California; and with Ocean Steamers at San Francisco, for all Points in China, Japan, Sandwich Islands, Oregon and Alaska.

■ TRAINS LEAVE their Splendid new Depot, on VanBuren Street, Chicago, as follows:

PACIFIC EXPRESS, (Sunday excepted).....	LEAVE. 10:00 a. m.	ARRIVE. 4:15 p. m.
PERU ACCOMMODATION, (Sundays excepted).....	4:30 p. m.	9:45 a. m.
PACIFIC EXPRESS, (Saturdays excepted).....	10:00 p. m. [Mon. ex. 7:00 a. m.]	7:00 a. m.

ELEGANT PALACE SLEEPING COACHES!

Run Through to Peoria and Council Bluffs, Without Change.

■ Connections at LA SALLE, with Illinois Central Railroad, North and South; at PEORIA, with Peoria, Pekin & Jacksonville Railroad, for Pekin, Virginia, &c.; at PORT BYRON JUNCTION, for Hampton, LeClaire, and Port Byron; at ROCK ISLAND, with Packets North and South on the Mississippi River.

■ For Through Tickets, and all desired information in regard to Rates, Routes, etc., call at the Company's Offices, No. 37 South Clark Street, Chicago, or 257 Broadway, New York.

A. M. SMITH, Gen. Pass. Agt. HUGH RIDDLE, Gen. Supt. P. A. HALL, Asst. Gen. Supt.

KANSAS PACIFIC RAILWAY.

Great Smoky Hill Route

THROUGH KANSAS TO DENVER, COLORADO,

Connecting with the DENVER PACIFIC R. R. for CHEYENNE; forming, in connection with the UNION and CENTRAL PACIFIC R. R.'s, a NEW ALL-RAIL ROUTE to

Colorado, Wyoming, Utah, Montana, NEVADA, CALIFORNIA, AND THE PACIFIC COAST.

THE ONLY ROUTE RUNNING PULLMAN DRAWING-ROOM & SLEEPING CARS THROUGH TO DENVER.

■ No Omnibus or Ferry Transfer! ■

■ Direct Connections made in UNION DEPOTS at Kansas City [State Line.] with the Hannibal & St. Joseph, North Missouri and Missouri Pacific Railroads.

■ Daily Trains leave Kansas City, State Line and Leavenworth, for Lawrence, Topeka, Emporia, Humboldt, New Chicago, Chetopa, Junction City, Abilene, Salina, Brookville, Ellsworth, Hays, KIT CARSON, DENVER, GREELEY, CHEYENNE, OGDEN, SALT LAKE CITY, CORINNE,

Sacramento & San Francisco.

■ Connect at Kit Carson with Southern Overland Passenger and Mail Coaches for PUEBLO, TRINIDAD, SANTA FE, and all principal points in

Old and New Mexico and Arizona.

■ Connect at DENVER with the Colorado Central Railroad and Fast Concord Coaches, for Golden City, Black Hawk, Central City, Idaho City, Georgetown and Fair Play.

Passenger and Freight Rates as low and conveniences as ample as by any Route.

Ask for Tickets via KANSAS PACIFIC RAILWAY, which can be obtained at all principal ticket offices in the United States.

R. B. GEMMELL, Gen. Ticket Agt. T. F. OAKES, Gen. Freight Agt. A. ANDERSON, Gen. Supt.

Lawrence, Kansas. Kansas City, Mo. Lawrence, Kan.

FARMS AND HOMES IN KANSAS.

Five Million Acres of Choice Farming Lands, situated along the line of this Great National Route, from one to six dollars per acre. For full particulars, apply to

JNO. P. DEVEREUX, Land Commissioner, Lawrence, Kan.

THE ERIE & PACIFIC DISPATCH CO.

Are Authorized Freight Agents.

For information, Contracts, and Bills of Lading, apply at their office, 64 Clark Street, Chicago.

H. H. RAPP, AGT.

Western Union Railroad.

CHICAGO & NORTHWESTERN DEPOT, MILWAUKEE & CHICAGO DEPOT,
 CHAGO.

THE DIRECT ROUTE!

CHICAGO, RACINE & MILWAUKEE,

TO

Beloit, Savanna, Clinton, Pt. Byron, Davenport, Mineral Point, Madison, Freeport, Fulton, Lyons, Rock Island, Sabula, Galena, Dubuque, Des Moines, Council Bluffs,

OMAHA, SAN FRANCISCO

AND ALL PRINCIPAL POINTS IN

Southern and Central Wisconsin, Northern Illinois, and Central and Northern Iowa.

FRED. WILD, D. A. OLIN,
 Gen. Ticket Agent. Gen. Superintendent.

THE FAVORITE THROUGH PASSENGER ROUTE!

Chicago, Burlington & Quincy RAILROAD LINE.

3 THROUGH EXPRESS TRAINS DAILY!

FROM CHICAGO	Hours.	1st Class Fare.	FROM CHICAGO	Days.	1st Class Fare.
TO OMAHA, - - -	23	\$20.00	TO DENVER, - - -	2½	\$63.00
" ST. JOSEPH, - - -	21	19.50	" SACRAMENTO, - - -	4½	118.00
" KANSAS CITY, - - -	22	20.00	" SAN FRANCISCO, 5	5	118.00

TRAINS LEAVE CHICAGO from the Great Central Depot, foot of Lake Street, as follows:

BURLINGTON, KEOKUK, COUNCIL BLUFFS & OMAHA LINE

7:40 A. M. MAIL AND EXPRESS. (Except Sunday,) stopping at all stations; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC FAST LINE. (Except Sunday,) stopping at Riverside, Hinsdale, Aurora, Leland, Mendota, Princeton, Buda, Kewanee, Galva, Galesburg, and all stations West and South of Galesburg.

ELEGANT DAY COACHES and PULLMAN PALACE DRAWING ROOM CARS are attached to this train daily from Chicago

TO COUNCIL BLUFFS & OMAHA WITHOUT CHANGE!

9:00 P. M. PACIFIC NIGHT EXPRESS. (Daily, except Saturday,) for Burlington, Ottumwa, Des Moines, Nebraska City, Council Bluffs, Omaha, and all points West. Pullman Drawing Room Sleeping Car attached to this Train daily from Chicago to Burlington, and Elegant Day Coaches, from Chicago to Council Bluffs and Omaha, without change! This is the Route between

CHICAGO, COUNCIL BLUFFS & OMAHA,

RUNNING THE CELEBRATED

Pullman Palace Dining Cars!

49 MILES THE SHORTEST ROUTE BETWEEN

Chicago & Keokuk,

And the Only Route Without Ferrying the Mississippi River!

QUINCY, ST. JOSEPH, LEAVENWORTH & KANSAS CITY LINE.

7:40 A. M. MAIL AND EXPRESS. (Except Sunday,) stopping at all stations between Chicago and Galesburg; making close connections at Mendota with Illinois Central for Amboy, Dixon, Freeport, Galena, Dunleith, Dubuque, LaSalle, El Paso, Bloomington, &c.

10:45 A. M. PACIFIC EXPRESS. (Daily, except Sunday,) with SLEEPING CARS attached, running through from Chicago to KANSAS CITY, Without Change!

9:00 P. M. PACIFIC NIGHT EXPRESS. (Daily,) with Pullman through from Chicago to QUINCY.

Kansas City, Lawrence, Topeka and Denver,

WITHOUT CHANGE!

Chicago and Kansas City!

WITHOUT CHANGE OF CARS OR FERRY.

115 MILES The Shortest Route bet. Chicago & St. Joseph.

THE SHORTEST, BEST AND QUICKEST ROUTE BETWEEN CHICAGO AND

Atchison, Weston, Leavenworth, Lawrence, AND ALL POINTS ON THE KANSAS PACIFIC R.Y.

Local Trains Leave { RIVERSIDE & HINSDALE ACCOMMODATION 7:00 A. M. 1:30 & 6:15 P. M.
GALESBURG PASSENGER 3:00 P. M.
MENDOTA PASSENGER 4:15 P. M.
AURORA PASSENGER 5:30 P. M.

Ask for Tickets via Chicago, Burlington & Quincy Railroad, which can be obtained at all principal offices of connecting roads, at Company's office, 63 Clark Street, and at Great Central Depot, Chicago, at as low rates as by any other route.

ROB'T HARRIS, SAM'L POWELL, E. A. PARKER,
Gen'l Superintendent, Gen'l Ticket Agent, Gen. West. Pass. Agt.,
CHICAGO.

THE GREAT THROUGH PASSENGER ROUTE TO KANSAS

IS VIA THE OLD RELIABLE

HANNIBAL & ST. JOSEPH SHORT LINE.

Crossing the Mississippi at Quincy and the Missouri at Kansas City on New Iron Bridges; running Three Daily Express Trains, Through Cars and Pullman Sleeping Palaces from Chicago & Quincy to St. Joseph & Kansas City.

The Advantages gained by this Line over any other Route from Chicago, are:

115 MILES THE SHORTEST!

To St. Joseph, Atchison, Hiawatha, Waterville, Weston, Leavenworth,

64 MILES THE SHORTEST!

To Kansas City, Fort Scott, Lawrence, Ottawa, Garnett, Iola, Humboldt, Topeka, Burlingame, Emporia, Manhattan, Fort Riley, Junction City, Salina, Ellsworth, Hays, Sheridan, Olathe, Paola, Cherokee Neutral Lands, Baxter Springs, Santa Fe, New Mexico, and all Points on the KANSAS PACIFIC, and MISSOURI RIVER, FT. SCOTT & GULF R.R.'s, with which we connect at Kansas City Union Depot.

THIS BEING THE SHORTEST LINE AND QUICKEST, is consequently the cheapest; and no one that is posted thinks of taking any other Route from Chicago to reach principal points in

Missouri, Kansas, Indian Territory, or New Mexico.

DAILY OVERLAND STAGES from west end Kansas Pacific Railway, for Pueblo, Santa Fe, Denver, and points in Colorado and New Mexico.

This is also a most desirable Route, via St. Joseph, to Brownsville, Nebraska City, Council Bluffs, and Omaha, connecting with the Union Pacific Railroad for Cheyenne, Denver, Salt Lake, Sacramento, San Francisco, and the Pacific coast.

Through Tickets for Sale at all Ticket Offices. Baggage Checked Through, and Omnibus Transfers and Ferriage avoided.

P. B. GROAT, Gen. Ticket Agent.

HANNIBAL, MO.

GEO. H. NETTLETON, Gen. Supt.

HANNIBAL, MO.

Old, Reliable, Air-Line Route!

CHICAGO, ALTON & ST. LOUIS R. R.

SHORTEST, QUICKEST AND ONLY DIRECT ROAD TO
Bloomington, Springfield, Jacksonville, Alton

ST. LOUIS!

WITHOUT CHANGE OF CARS.

THE ONLY ROAD MAKING IMMEDIATE CONNECTIONS AT ST. LOUIS
WITH MORNING AND EVENING TRAINS

—FOR—

ATCHISON, LEAVENWORTH, KANSAS CITY,

Lawrence, Topeka, Memphis, New Orleans,

And All Points South and Southwest.

TRAINS leave CHICAGO from the West-side Union Depot, near Madison Street Bridge.

	Depart.	Arrive.
EXPRESS MAIL...	9:15 A. M.	8:05 P. M.
JOLIET ACCOMMODATION...	4:00 P. M.	9:40 A. M.
NIGHT EXPRESS...	7:30	12:50 P. M.
LIGHTNING EXPRESS...	9:00	7:30 A. M.

*Sundays excepted.
†Daily; Saturdays it runs to Bloomington only.
§Saturdays and Sundays excepted. Monday mornings this train runs from Bloomington to St. Louis.

This is the ONLY LINE Between CHICAGO & ST. LOUIS RUNNING

Pullman's Palace Sleeping and Celebrated Dining Cars!

BAGGAGE CHECKED THROUGH.

Through Tickets can be had at the Company's office, No. 55 Dearborn street, Chicago, or at the Depot, corner of West Madison and Canal streets, and at all principal Ticket Offices in the United States and Canada. Rates of Fare and Freights as low as by any other Route.

A. NEWMAN, Gen. Pass. Agent.

J. C. McMULLIN, Gen. Supt.

North Missouri R. R.

PASSENGERS FOR
KANSAS AND THE WEST,ARE REMINDED THAT
THE NORTH MISSOURI R. R.
IS—

11 MILES SHORTER than any other Route!

BETWEEN
St. Louis and Kansas City.

15 Miles Shorter between ST. LOUIS and LEAVENWORTH

AND
50 MILES SHORTER TO ST. JOSEPH!
THAN ANY OTHER LINE OUT OF ST. LOUIS.

Three Through Express Trains Daily!

Pullman's Celebrated Palace Sleeping Cars on all Night Trains!

FOR TICKETS, apply at all Railroad Ticket Offices, and see that you get your Tickets via St. Louis and North Missouri Railroad.

JAMES CHARLTON,
Gen. Pass. and Ticket Agent, St. Louis.W. R. ARTHUR,
General Superintendent, St. Louis.

Pacific Railroad of Missouri.

THE MOST DIRECT AND RELIABLE ROUTE FROM ST. LOUIS THROUGH TO

KANSAS CITY, LEAVENWORTH & ATCHISON,

WITHOUT CHANGE OF CARS!

Close Connections at KANSAS CITY with Missouri Valley, Missouri River, Ft. Scott & Gulf, and Kansas Pacific R.Y.'s, for Weston, St. Joseph, Junction City, Fort Scott, Lawrence, Topeka, Sheridan, Denver, Fort Union, Santa Fe, and

ALL POINTS WEST!

At SEDALIA, WARRENSBURG and PLEASANT HILL, with Stage Lines for Warsaw, Quincy, Bolivar, Springfield, Clinton, Ossela, Lamar, Carthage, Granby, Neosho, Baxter Springs, Fort Gibson, Fort Smith, Van Buren, Fayetteville, Bentonville.

PALACE SLEEPING CARS on all NIGHT TRAINS.
Baggage Checked Through Free!

THROUGH TICKETS for sale at all the Principal Railroad Offices in the United States and Canada. Be Sure and Get your Tickets over the PACIFIC R. R. OF MISSOURI.

W. B. HALE,
Gen. Pass. and Ticket Agt.THOS. MCKISSOCK.
General Superintendent

61 Miles the Shortest Line!
 — FROM —
CHICAGO TO NEW YORK.

Pitts., Ft. Wayne & Chicago
 — AND —
PENNSYLVANIA CENTRAL

IS THE ONLY ROUTE

Running its Entire Trains **THROUGH** to Philadelphia and New York, and the only Route running Three Daily Lines of Pullman Day and Sleeping Palaces, from Chicago to

PITTSBURGH, HARRISBURG,
PHILADELPHIA & NEW YORK,
 — WITHOUT CHANGE!

WITH BUT ONE CHANGE TO

BALTIMORE, PROVIDENCE, NEW HAVEN, HARTFORD,
SPRINGFIELD, WORCESTER & BOSTON!

AND THE MOST DIRECT ROUTE TO WASHINGTON.

	Mail.	Fast Express.	Pacific Exp.	Night Exp.
Leave — CHICAGO	5.30 A. M.	9.00 A. M.	5.15 P. M.	9.00 P. M.
Arrive — PLYMOUTH	9.50 "	12.03 P. M.	8.45 "	12.35 A. M.
— FORT WAYNE	"	"	2.05 "	3.10 "
— LIMA	3.24 "	4.06 "	1.28 A. M.	5.40 "
— FOREST CITY	4.43 "	5.08 "	2.45 "	7.07 "
— CRESTLINE	6.20 "	6.30 "	4.20 "	8.55 "
Leave — CRESTLINE	6.00 A. M.	6.50 "	4.30 "	8.35 "
Arrive — MANSFIELD	6.40 "	7.17 "	5.00 "	10.05 "
— ORRVILLE	9.15 "	9.05 "	6.54 "	11.35 "
— ALLIANCE	11.10 "	10.40 "	8.30 "	13.30 P. M.
— PITTSBURGH	3.45 P. M.	1.55 A. M.	12.10 P. M.	4.40 "
— CRESSON	11.57 "	5.44 "	4.48 "	10.00 "
— ALTOONA	12.48 A. M.	6.55 "	5.55 "	2.40 A. M.
— HARRISBURG	5.30 "	11.25 "	10.45 "	2.50 "
— PHILADELPHIA	6.50 "	3.15 "	3.00 "	6.50 "
— NEW YORK, VIA PHILADELPHIA	10.30 "	6.30 "	6.41 "	10.30 "
— NEW YORK, VIA ALLENTOWN	10.30 "	6.30 "	6.41 "	10.30 "
— BALTIMORE	9.15 P. M.	8.05 "	2.30 A. M.	9.15 P. M.
— WASHINGTON	1.00 "	5.15 "	5.45 "	1.00 "
— BOSTON	9.00 "	5.50 A. M.	6.00 "	9.00 "

Boston and New England Passengers will find this Route especially Desirable, as it gives them an opportunity of seeing the FINEST VIEWS AMONG THE ALLEGHENY MOUNTAINS.

Besides Visiting PITTSBURGH, PHILADELPHIA and NEW YORK, without extra cost!

Ask for Tickets via COLUMBUS for the East, and via "THE AIR LINE" for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO**, and at Principal Ticket Offices in the West and Northwest.

CLOSE CONNECTIONS made at LIMA for all Points on the Dayton & Michigan and the Cincinnati, Hamilton & Dayton Railways, and at CRESTLINE for Cleveland and Columbus.

Express Trains are Equipped with WESTINGHOUSE AIR BRAKES,
 The Most Perfect Protection Against Accidents in the World!

F. R. MYERS, Gen. Pass. & **W. C. CLELAND,** Gen. Western Pass. Agt. P. F. W. & C. R'y Chicago. | Gen. Western Pass. Agt. P. F. W. & C. R'y Chicago.
T. L. KIMBALL, Gen. Western Pass. Agt. Penn. Cen. R. R. Chicago.

Broad Gauge! Double Track!
ERIE RAILWAY.

4 EXPRESS TRAINS DAILY!
 From Cleveland, Dunkirk and Buffalo, 625 Miles, to New York, WITHOUT CHANGE of Coaches!

The Trains of this Railway are run in DIRECT CONNECTION WITH ALL WESTERN AND SOUTHERN LINES, for

Elmira, Williamsport, Oswego, Great Bend, Scranton, Newburgh,

NEW YORK, ALBANY, BOSTON, PROVIDENCE,
 AND PRINCIPAL NEW ENGLAND CITIES.

New and Improved DRAWING ROOM COACHES are attached to the DAY EXPRESS Running THROUGH TO NEW YORK.

SLEEPING COACHES, Combining all Modern Improvements, with perfect Ventilation and the peculiar arrangements for the comfort of Passengers incident to the **BROAD GAUGE**, accompany all night trains to New York.

CONNECTIONS CERTAIN! as Trains on this Railway will, when necessary, wait from one to two hours for Western trains.

All Trains of Saturday run directly through to New York.

Ask for Tickets via Erie Railway, which can be procured at 66 Clark Street, Chicago, and at all Principal Ticket Offices in the West and Southwest.

L. D. RUCKER, A. J. DAY, WM. R. BARR, Gen. Superintendent New York | Western Passenger Agent, Chicago. | Gen. Passenger Agent, New York.

Pan-Handle
 — AND —
Penn'a Central Route East!

SHORTEST AND QUICKEST ROUTE, VIA COLUMBUS, TO
PITTSBURGH, BALTIMORE, PHILADELPHIA & NEW YORK

On and after Sunday, NOVEMBER 20th, 1870, Trains for the East will run as follows:

[DEPOT CORNER CANAL AND KINZIE STS., WEST SIDE.]

7:40 A. M. DAY EXPRESS.

[SUNDAYS EXCEPTED.] Via Richmond. Arriving at

COLUMBUS... 8:00 A. M. HARRISBURG... 10:35 P. M. NEW YORK... 6:40 A. M. WASHINGTON... 5:45 A. M.

PITTSBURGH... 12:15 P. M. PHILADELPHIA... 8:10 A. M. BALTIMORE... 2:30 A. M. BOSTON... 5:05 P. M.

7:10 P. M. NIGHT EXPRESS.

[SUNDAYS EXCEPTED.] Arriving at:

COLUMBUS... 11:15 A. M. HARRISBURG... 5:20 A. M. NEW YORK... 11:40 A. M. WASHINGTON... 1:10 P. M.

PITTSBURGH... 7:35 P. M. PHILADELPHIA... 9:50 A. M. BALTIMORE... 9:30 A. M. BOSTON... 11:50 P. M.

Palace Day and Sleeping Cars

Run Through to COLUMBUS, and from Columbus to NEW YORK, WITHOUT CHANGE!

ONLY ONE CHANGE TO NEW YORK, PHILADELPHIA, OR BALTIMORE!

CINCINNATI & LOUISVILLE AIR LINE SOUTH.

35 Miles the Shortest Route to Cincinnati.

18 Miles the Shortest Route to Indianapolis and Louisville.

3 Hours the Quickest Route to Cincinnati!

THE SHORTEST AND BEST ROUTE TO

Columbus, Chillicothe, Hamilton, Wheeling, Parkersburg, Evansville, Dayton, Zanesville, Marietta, Lexington, Terre Haute, Nashville, ALL POINTS IN CENTRAL & SOUTHERN OHIO, & INDIANA, KENTUCKY & VIRGINIA.

— QUICK, DIRECT AND ONLY ALL RAIL ROUTE TO —

New Orleans, Memphis, Mobile, Vicksburg, Charleston, Savannah,

AND ALL POINTS SOUTH.

Cincinnati, Indianapolis and Louisville Trains run as follows:

THROUGH WITHOUT CHANGE OF CARS!

7:40 A. M.

(Sundays excepted) Arriving at

LOGANSPORT... 1:15 P. M. LOGANSPORT... 1:15 P. M.
 KOKOMO... 2:35 P. M. KOKOMO... 2:31 A. M.
 CINCINNATI... 10:10 P. M. CINCINNATI... 9:35 A. M.
 INDIANAPOLIS... 5:00 P. M. INDIANAPOLIS... 5:40 A. M.
 LOUISVILLE... 11:30 P. M. LOUISVILLE... 3:50 P. M.

Lansing Accommodation: Leaves 3:40 P. M. Arrives 10:55 A. M.

PULLMAN'S PALACE SLEEPING CARS!

Accompany all Night Trains between Chicago and Cincinnati or Indianapolis.

Ask for Tickets via COLUMBUS for the East, and via "THE AIR LINE" for Cincinnati, Indianapolis, Louisville and points South. Tickets for sale and Sleeping Car Berths secured at **95 RANDOLPH STREET, CHICAGO**, and at Principal Ticket Offices in the West and Northwest.

WM. L. O'BRIEN, Gen. Pass. and Ticket Agent, Columbus.

I. S. HODSDON, Northwestern Pass. Agt. Chicago.

D. W. CALDWELL Gen. Supt. Columbus.

The Great Favorite Route for Missouri, Nebraska and Iowa.

KANSAS CITY, ST. JOSEPH

— AND —

COUNCIL BLUFFS

— THROUGH LINE! —

3 EXPRESS PASSENGER TRAINS Leave Union Depot Daily, on the arrival of Eastern Southern and Western Trains, crossing the Missouri River on the New Iron Bridge at KANSAS CITY, passing the cities of

LEAVENWORTH, ATCHISON, SAINT JOSEPH,
 — AND —
NEBRASKA CITY.

Connecting at COUNCIL BLUFFS with Iowa Lines for all prominent points in Iowa, and making DIREC

CONNECTION at OMAHA with the Great Union Pacific Railroad, for CHEYENNE, DENVER, SALT LAKE, SACRAMENTO, SAN FRANCISCO And the Pacific Coast.

Pullman's Palace Sleeping Cars!

ON ALL NIGHT TRAINS.

Ask for Tickets via the People's Favorite Route, Kansas City, St. Joseph & Council Bluff Railroad Line.

A. L. HOPKINS, Gen. Superintendent ST. JOSEPH, Mo.

A. C. DAWES, Gen. Passenger Agent, ST. JOSEPH, Mo.

**LAKE SHORE
— AND —
MICHIGAN SOUTHERN R.W.**

THE GREAT THROUGH LINE BETWEEN
CHICAGO, BUFFALO & NEW YORK,
WITHOUT CHANGE!
AND THE ONLY RAILWAY
RUNNING PALACE COACHES THROUGH!
— BETWEEN —
CHICAGO & NEW YORK, via BUFFALO
WITHOUT TRANSFER OF PASSENGERS!

All Trains Stop at Twenty-Second Street to Take and Leave Passengers.
Baggage Checked at that Station for all Points East.

4 EXPRESS TRAINS DAILY, [Sundays Excepted,] Leave
Chicago from the New Depot, on Van Buren St., at the head of L a Salle Street, as follow

5:30 A. M. MAIL TRAIN.
VIA OLD ROAD AND AIR LINE. SUNDAYS EXCEPTED.

Leaves 23d Street 7:45 A. M. Stops at all Stations. Arrives—Cleveland, 9:35 P. M.

9:00 A. M. SPECIAL NEW YORK EXPRESS,
VIA AIR LINE. SUNDAYS EXCEPTED.

Leaves—Twenty-Second Street, 9:15 A. M. Arrives—Elkhart, 12:45 P. M.; Cleveland 9:45 P. M.; Buffalo, 4:10 A. M.; New York, 7:00 P. M.; (Chicago Time) Boston, 11:45 P. M.

This Train has PALACE SLEEPING COACH Attached, Running
THROUGH TO ROCHESTER, WITHOUT CHANGE!

IN DIRECT CONNECTION WITH

Wagner's Celebrated Drawing-Room Coaches on N. Y. Central R. R.
Only Thirty-Three Hours, Chicago to New York!

5:15 P. M. ATLANTIC EXPRESS (Daily),
VIA OLD ROAD.

Leaves—Twenty-Second Street 5:30 P. M. Arrives—Laporte, 8:10 P. M. (Stops 20 minutes or Supper); arrives at Toledo, 9:30 A. M.; Cleveland, 7:35 A. M. (30 minutes for Breakfast); arrives at Buffalo, 1:50 P. M.; Rochester, 5:10 P. M. (30 minutes for Supper); connects with Sleeping Coach running Through from Rochester to Boston Without Change, making but One Change between Chicago and Boston.

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Leaves—Twenty-Second Street, 9:15 P. M. Arrives—Toledo, 6:15 A. M. (30 minutes for Breakfast); arrives at Cleveland, 10:30 A. M.; Buffalo, 6:50 P. M.; New York, 12:00 M.; Boston, 3:50 P. M.

KALAMAZOO DIVISION.

Leave Chicago 9:00 A. M. Arrive at Kalamazoo 4:10 P. M.;
Grand Rapids, 7:10 P. M.

Leave Chicago 9:00 P. M. Arrive at Kalamazoo 7:25 A. M.;
Grand Rapids, 10:15 A. M.

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Vicksburg 9:25 A. M., New Orleans 11:05 A. M.

8:15 P. M. CAIRO EXPRESS, Except Saturdays.
Arriving at Cairo 12:24 P. M., Memphis 4:15 A. M., Little Rock 7:00 P. M.,
Vicksburg 8:10 P. M., New Orleans 1:30 A. M.

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HYDE PARK TRAIN...	8:00 A. M.	9:30 A. M.	HYDE PARK TRAIN...	5:15 P. M.
HYDE PARK TRAIN...	12:10 P. M.	1:45 P. M.	HYDE PARK TRAIN...	7:35 P. M.

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(SUNDAYS EXCEPTED.)

Arrives DETROIT at 6:30 P. M.

9:00 A. M. SPECIAL NEW YORK & BOSTON EXP.
(SUNDAYS EXCEPTED.) Arrives at Michigan City 11:10 A. M.; Niles 12:40, [Dinner], Kalamazoo 2:15 P. M.; Battle Creek 3:00, Marshall 3:24, Jackson 4:30, Detroit 6:55; London 12:05 A. M.; Hamilton 2:35 A. M.; Toronto 10:00, Suspension Bridge 4:40, Rochester 7:15 A. M.; Albany, 2:25 P. M.; NEW YORK, 7:00; BOSTON, 11:45 P. M. This train connects at ROCHESTER (7:15 A. M.) with

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—
RUNNING THROUGH TO NEW YORK, WITHOUT CHANGE!

5:15 P. M. ATLANTIC EXPRESS.

(DAILY.) Arrives at Michigan City, 7:22 P. M.; Niles 8:55 P. M. [Supper]; Kalamazoo, 10:30 P. M.; Jackson, 1:05 A. M.; Detroit 3:45, London, 8:35, [Breakfast]; Hamilton 11:40, Suspension Bridge 2:35 P. M.; Rochester 5:10 P. M.; Albany, 1:50 A. M.; NEW YORK, 7:15 A. M.; BOSTON, 11:00 A. M. A MAGNIFICENT DRAWING-ROOM SLEEPING CAR is attached to this train daily, FROM CHICAGO TO NEW YORK CITY. The celebrated

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9:00 P. M. NIGHT EXPRESS.

(SAT. & SUN. EXCEPTED.) Arrives at Michigan City, 11:10 P. M.; Niles, 12:38 A. M.; Kalamazoo, 2:10; Marshall, 3:25; Jackson, 4:45; Grand Trunk Junction, 7:00; Detroit, 7:45; London, 1:45 P. M.; Hamilton, 4:35; Toronto, 9:35; Niagara Falls, 6:25; Buffalo, 7:15 P. M.; Rochester, 9:05; Syracuse, 12:25 A. M.; Rome, 1:55; Utica, 2:25; Albany, 6:30 A. M.; NEW YORK, 12:00 M.; BOSTON, 3:50 P. M.

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4:30 P. M. AFTERNOON EXPRESS
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